



**FACE THE FUTURE  
EQUIPPING TO  
MEET THE NEW  
GLOBAL THREATS**  
**UK DEFENCE P30**

**SO LONG SIKORSKY**

UTC confirms helicopter division may be offloaded after 86 years to ease shareholder pressure **7**

**CHASING THE SUN**

Solar Impulse stresses 'everyday technology' behind its round-the-world adventure **18**

# FLIGHT INTERNATIONAL

From Flightglobal

17-23 MARCH 2015

**PRODUCTION**

## KEEP ON BOEING

The push to sell 777s as successor waits in wings



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**COVER IMAGE**

A shot of a Thai Airways Boeing 777-300ER at Oslo airport by AirTeamImages' Jorgen Syversen illustrates our news analysis on 777 production targets P10

**BEHIND THE HEADLINES**

Operations and safety editor David Learmount was with Airbus in Toulouse to look at emerging pilot technology, like an eye-tracking headset being used during research by the Institut Supérieur de l'Aéronautique et de l'Espace P8

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AgustaWestland

Rex Features, Solar Impulse

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The Power of Flight

**IMAGE OF THE WEEK**

Recently transferred to the UK Royal Navy's Commando Helicopter Force from the Royal Air Force's inventory, an AgustaWestland Merlin HC3 of 846 NAS touches down at Bardufoss in Norway, during Arctic training. Flightglobal's Ascend Fleets database records the RN as now having seven Merlin HC3/3As

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[flight-international](http://flight-international.com)



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**THE WEEK IN NUMBERS**

 **13%**

The proforma growth in Alcoa aerospace revenue, to \$5.6bn, from its acquisition of RTI International Metals

Alcoa

**£14.4m**

Flightglobal.com

Virgin Atlantic's pre-tax profit for 2014 – equivalent of \$21.7 million – was its first positive result since 2011

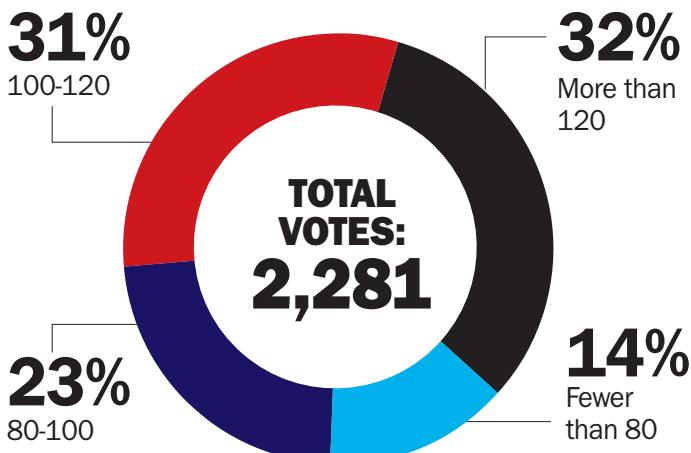
 **30**

Flightglobal.com

Adding ARJ21-700s to an order for 45 C919s makes lessor ICBC the largest customer for China's Comac

**QUESTION OF THE WEEK**

Last week, we asked: **By 2019, how many Airbus and Boeing narrowbodies will be made monthly?** You said:



This week, we ask: **Who will buy Sikorsky?**

- Boeing
- Textron
- Someone else
- Spun off as standalone company
- UTC will keep it

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# No time for sleeping

It was optimism all round at the air transport traders' annual get-together in Phoenix, but galloping production rates, low oil prices and political instability will be keeping some awake

**N**ot until the very last panel of the ISTAT conference did someone in the audience ask the one question that had been hovering over the event for two days.

Until that moment, attendees had heard much about a commercial aircraft industry that is mostly in a great shape, with record backlogs, surging traffic growth, improving aircraft values and no analytic reason to think it will change course soon. So, regardless of all the good news, the anonymous questioner asked, what is keeping the panellists awake at night?

On the stage were the captains of the aircraft leasing community, who gather with aircraft traders, financiers and manufacturers in a plush resort hotel on the outskirts of eternally sunny Phoenix, Arizona for an annual dialogue on the state of the air transport industry.

Most years, the public conversation covers a wide variety of financial issues, but also focuses on the kind of overriding, capital-T "Topics" that tend to rattle the

## The near-absence of the phrase "order bubble" during the ISTAT dialogue spoke volumes

psyches of the people who trade in aircraft worth tens of millions or even hundreds of millions of dollars.

For an industry that has experienced an unprecedented 11 years of steady growth, it had always been easy to find something that everyone attending agreed to worry about. Several years ago it was how the industry would cope with the global financial crisis, but then it did. Then the worry was over where the capital would come from to pay for all those aircraft being delivered with hefty financing packages, but somehow the credit materialised. More recently, fears



Rex Features

**The clock's still ticking**

focused on talk of order bubbles and the declining service lives of narrowbody aircraft.

While not everyone is resting at ease, the near-absence of the phrase "order bubble" in the ISTAT dialogue spoke volumes about its current relevance. So what is keeping the aircraft trading community up at night these days?

Digging deep into the remarks made over the two days revealed a few worries. The price of oil should remain well below \$100 per barrel for years to come, it was said, unless a geopolitical crisis overwhelms market forces. Russia's recent actions in eastern Europe suggest a "catastrophic" geopolitical event is now more likely than ever, but that is still a remote possibility. Airbus and Boeing are entering a potentially awkward transition to a series of new and re-engined models, as galloping production rates stoke fears of over-supply.

But these are all manageable problems. The industry has every right to feel optimistic, and that seems to be why some may be having trouble sleeping. ■

**See This Week P7, Air Transport from P10**

## Solar Impulse's global challenge

**I**n this age of intercontinental travel, the setting of aviation records may seem like a throwback to a bygone era. But there remain boundaries to push, and Solar Impulse's bid to set new endurance standards for solar powered, no-fuel flying is impressive and important.

Impressive because to build a 747-sized aircraft with the mass of a family car capable of flying day and night on the power of a motor scooter requires a new state-of-the-art in design, materials, power management and avionics, not to mention pilot fitness.

Important because achieving all those things shows that the "impossible" is possible with existing technologies. For André Borschberg and Bertrand Piccard, that "impossible" is not flying round-the-world in a solar

aircraft – it is the dramatic reduction in energy consumption needed to prevent runaway climate change.

Their message, to be repeated to anyone who will listen at every stop on their journey, is to ditch the fatalistic assumption that only a return to Stone Age lifestyles can avert cataclysmic global warming. Here, they are saying, in this magnificent aircraft, is the proof.

But can Solar Impulse realistically hope to inspire "concrete action toward a clean future"? We should all hope so – although it is entirely possible that many people will compare their own lifestyle options with such a fragile, expensive and impractical machine, however impressive, and remain mired in fatalism. ■

**See News Focus P18**



To access more of our coverage from the annual ISTAT event, login or register online at [flightglobal.com/dashboard](http://flightglobal.com/dashboard)



# BRIEFING

## MALAYSIAN A400M TO STAR AT LIMA SHOW

**AIRLIFT** Malaysia took delivery of its first Airbus A400M tactical transport on 9 March, clearing the way for the turboprop-powered type's participation in the LIMA air show later this month. One of four Atlas airlifters ordered for the Royal Malaysian Air Force, it will enable the service to "undertake an extraordinary range of military and humanitarian operations", says chief of staff Gen Roslan Bin Saad.

## AIDC TO BUILD ON TRENT XWB SUCCESS

**ENGINES** Taiwan's Aerospace Industrial Development Corporation (AIDC) is investing NT\$1.3 billion (\$41.2 million) to construct a third factory, dedicated to engine casing work. The facility, which will focus on work for the Rolls-Royce Trent XWB, could in the future also work on CFM International's Leap engine, says AIDC. The new Kaohsiung factory is expected to be completed by the end of the year, and scheduled to be operational in the second quarter of 2016.

## NABTESCO TO SUPPLY 777X ACTUATION

**SUPPLY CHAIN** Japanese firm Nabtesco is to supply primary flight control actuation for Boeing's in-development 777X. Nabtesco is a long-time partner on the 777, supplying actuators for four flight control surfaces. This agreement will double that to eight flight control surfaces, including spoilers. Japanese firms will play a big role in the 777X. Boeing announced last year that Mitsubishi Heavy Industries, Kawasaki Heavy Industries, Fuji Heavy Industries, ShinMaywa and Nippon will supply 21% of the 777X airframe structure.

## A4A STEPS BACK FROM GULF 'SUBSIDIES' CAMPAIGN

**COMPETITION** US trade association Airlines for America (A4A) has maintained its distance from a campaign led by its three biggest members against alleged subsidies to Gulf carriers. Stopping short of throwing support behind the effort led by Delta Air Lines, American Airlines and United Airlines, the association has called for a "national airline policy" for US carriers to compete more effectively.

## THAI TO FURLOUGH 22 AIRLINERS TO CUT COSTS

**FLEET** Thai Airways International will decommission 22 aircraft this year, as it works to streamline its fleet as part of a restructuring plan aimed at bringing the airline back to profitability. Speaking to Flightglobal, president Charaporn Jotikasthira says the aircraft to be removed from service are six Airbus A340s, six A330s, eight Boeing 747s and two 747 Boeing Converted Freighters. This is on top of the roughly 20 aircraft the carrier has already grounded.

## UNMANNED G-STAR CLEARS QUALIFICATION TEST

**TESTING** The G-Star unmanned air system jointly developed and marketed by Israeli manufacturer Innocon and G-Force Composites of Thailand has completed qualification test flights at 10,000ft, and performed automatic take-offs and landings at its 200kg (440lb) maximum weight. Discussions continue with potential customers for the 8m (26ft)-wingspan type, which has a current 10h endurance.

## NASA: SOLID BOOSTER TEST MARKS SLS MILESTONE

**SPACEFLIGHT** NASA's progress towards a 2018 uncrewed test flight of its massive Space Launch System took a step forward with a 2min ground firing of one of its solid boosters. The Utah test by supplier Orbital ATK will be followed by a liquid stage test firing in May or June and a second solid booster test in early 2016. The uncrewed 2018 test flight will carry Lockheed Martin's Orion crew capsule.



Saab

Officials refer to a "Brazil effect" with other potential buyers

**FIGHTERS** CRAIG HOYLE LONDON

# Saab bullish over Gripen prospects

Airframer confident of additional sales, as 36-aircraft deal nears conclusion and first prototype E-model takes shape

**S**aab's final assembly work on its first prototype Gripen E/NG fighter is "well under way", the company says, as officials report unprecedented market interest in the product.

The first fuselage sections of test aircraft 39-8 have already come together in Linköping, demonstrating the benefits of its all-digital design, says Jerker Ahlqvist, head of the company's Gripen business unit.

"The first sections are being put together in the workshops," says Ahlqvist. "We put them together and they fit immediately – this shows we're on the right track." The aircraft is due to be rolled out during 2016, supporting a programme to deliver the first of 60 Gripen Es to the Swedish air force in 2019.

Also linked to the development is a two-seat demonstrator, which has logged 281h in 315 flights.

Speaking during a Gripen seminar in Stockholm on 12 March, Ulf Nilsson, the head of Saab's aeronautics business unit, said the final elements of a 36-aircraft deal with Brazil are expected to be in place by mid-year.

"It's moving forward in a good way, according to plan when it comes to approving the financial solution and export licences," he comments.

Around 100 Brazilian engineers are due to arrive in Linköping by the end of 2015 to participate in training and airframe development activities, including those linked to a two-seat version of the fighter.

Under a progressive ramp-up of Brazilian involvement in the programme, Ahlqvist says "maybe 10 to 15" of Brazil's 36 aircraft will undergo final assembly at Embraer. "They will have a full capability to manufacture Gripen in the future, and to create a fighter capability in Brazil," he adds.

"Already we have seen the 'Brazil effect,'" Ahlqvist says, with several of the nation's neighbours "showing an interest" in the type.

"We have never had such a strong situation," says Nilsson. "We have a business case where we can talk about 300 aircraft, and the potential to sell up to 450. We see good opportunities to have [additional] customers in the near future."

Meanwhile, Saab says Sweden is in negotiations with Slovakia linked to a potential deal to supply Gripen C/Ds to the European nation, with a decision anticipated later this year. Additional potential users in the region could include Bulgaria. ■



Jakarta urged to  
up game on safety  
THIS WEEK P9

DIVESTMENT STEPHEN TRIMBLE WASHINGTON DC

# UTC looks to spin off poor fit Sikorsky

Helicopter manufacturer – an original part of group from 1929 – may be divested as part of strategic business review

**S**ikorsky could become a stand-alone company after a tax-free spinoff, under an option now being reviewed by parent company United Technologies (UTC).

The Stratford, Connecticut-based helicopter manufacturer was a founding member of UTC in 1929, but it has increasingly come under scrutiny by Wall Street investors who regard it as a poor fit under UTC's current corporate structure.

Former chief executive of UTC Louis Chenevert resigned abruptly last November, and in December, the newly-appointed Gregory Hayes was continuing his predecessor's defence of Sikorsky as a critical member of a corporation that includes engine manufacturer Pratt & Whitney and aircraft electronics and systems supplier United Technologies Aerospace Systems.

But early last month UTC announced a strategic business review. This will consider divest-



military and commercial helicopter platforms. It has unmatched technological capabilities, outstanding people and a strong backlog," he adds.

"Looking to the future, we are evaluating whether Sikorsky's unique business as a rotorcraft OEM with a predominately military customer base is best positioned as a stand-alone company, and whether a separation would allow United Technologies to better focus on providing high-technology systems and services to the aerospace and building industries."

The review should be completed by the end of the year, but UTC has set no "specific timetable" for making a final decision.

An 11 March statement released by UTC did not discuss the possibility of selling Sikorsky to another company or group of investors, although it says there is more than one option being reviewed. ■

**The rotorcraft OEM has a predominately military customer base**

ing business units that fail to meet certain performance criteria – including whether they generate earnings growth above gross domestic product, have operating margins above 15% on a sustainable basis, returns in excess of invested capital and a track record of reliable cash flow.

"We are exploring strategic options for Sikorsky to determine the best way to enhance its long-term success and create improved long-term value for UTC's customers and shareholders," Hayes says. "Today, Sikorsky is a world leader in the design, manufacture and service of

REPLACEMENT STEPHEN TRIMBLE PHOENIX

# Udvar-Hazy angles for a bigger 757 replacement

**H**ints are emerging of Boeing's intentions for a clean-sheet large aircraft to follow the 777X into service after 2022.

Air Lease Corp founder Steven Udvar-Hazy, one of the industry's most influential customers, says he is aware of Seattle's secret designs, but will not reveal them.

"It's really not correct for me to tell you what's going on in the design chambers in Seattle," Udvar-Hazy said during the ISTAT conference in Phoenix, Arizona.

He is, however, legally able to express his preference for what he describes as a 200-250-seat aircraft occupying the gap in Boeing's portfolio between the 737 Max 9 and the 787-8.

"This is just my personal view. It's going to evolve somewhere between a 757 and 767-200, size-wise," Udvar-Hazy says.

Although often referred to as a 757 replacement, Udvar-Hazy's discussions with potential airline customers suggest the aircraft should be different. It should have the 2,300m (7,000ft) runway take-off performance of the 757-200, giving it the capability to access New York's metropolitan LaGuardia airport, he says, but at the same time resemble the size of the twin-aisle 767-200.

Asked if he prefers a twin-aisle aircraft in that size category, Udvar-Hazy says: "Yes – and sometimes we prevail."

If Udvar-Hazy's preferences hold sway, the project could challenge chief executive James McNerney's stated view that Boeing should avoid "moonshot" development projects.

Packaging a twin-aisle fuselage width into an aircraft with the

take-off performance of a single-aisle – without sacrificing higher fuel efficiency targets – is a challenge, but one that airlines need.

For three years, Boeing has acknowledged interest in the market space between the 737 Max 9 and the 787-8. It remains focused on developing an aircraft with about 20% more range and greater size than the 757-200, vice-president of marketing Randy Tinseth said at ISTAT.

In the meantime, Airbus has launched a long-range version of the A321neo that comes close to matching the 757-200's range.

"We've looked at the A321LR," says Ron Baur, United Airlines' vice-president of fleet. "But we have the luxury of time in terms of waiting that we can see what Boeing's going to do in terms of an airplane for the market." ■



AirTeamImages

**United will wait for Boeing response to long-range A321neo**



**RESEARCH** DAVID LEARMOULD TOULOUSE

## ISAE tests focus on pilot stress due to workload

**F**rench aerospace engineering school the Institut Supérieur de l'Aéronautique et de l'Espace in Toulouse is researching pilot physiological and neurological stress responses to recognise the signals that precede potential errors.

Backed by the AXA Research Fund, the ISAE wants to understand pilots' neurological activity when they become confused, overloaded, or focused on non-critical inputs instead of critical ones. This can result in illogical activity, leading to accidents like the Air France flight 447 loss of 2009.



**Brain activity was monitored**

Tools used to monitor pilot reactions during flight simulator exercises and real flights include eye-tracking, measurement of pupil dilation, deep brain activity

via electro-encephalogram readings and infrared sensors that can show the level of activity in critical surface brain areas.

Prof Frederic Dehais, the AXA chair of neuroergonomics for flight safety at ISAE SUPAERO in Toulouse, says even factors such as "emotional bias" can be recognised. This can be caused, for example, by pilot perception of commercial pressure to land when a go-around would be wiser.

Tests intended to put high workload stress on pilots show progressive neurological reac-

tions, and neurologists can watch as the rational part of the brain deactivates. This is the state in which pilots, for example, ignore loud alert chimes.

This new understanding promises to enable manufacturers to eliminate alerts that do not work, and develop completely new systems for attracting the attention of pilots whose cognitive capacity has been swamped: such as a window appearing on the navigation display showing an animation of a pilot carrying out the required action. ■

**CAPABILITY** DOMINIC PERRY RAF BENSON

## UK studying future rotorcraft needs

Discussions ongoing around military helicopter requirements post-2025, as current fleet modernisation hits halfway point



Crown Copyright

**Five types will provide the backbone for operations by the Royal Air Force, Royal Navy and British Army, as Apache decision nears**

**W**ith an ongoing upgrade of the UK's military helicopter fleet around 50% complete, discussions have begun within the Ministry of Defence about its rotorcraft requirements beyond the middle of the next decade.

Launched in 2009, the tri-service enhancement and rationalisation programme will eventually see the armed forces concentrate on five core types. Significant capability improvement work has also been carried out on the AgustaWestland AW101 Merlin, Airbus Helicopters Puma and Boeing CH-47 Chinook, to bring them to new operating standards.

"The task is to continue the delivery of all the upgrades to the numbers contained in the strategy we are halfway through," says Air Vice Marshal Julian Young, the newly-appointed director, helicopters, at the Defence Equipment & Support procurement body. But at an event at the RAF's Benson base in Oxfordshire on 12 March, he said the UK's Joint Helicopter Command has started to "study future helicopter requirements".

Over the past two months, initial operating capability has been declared for the RAF's new-build Chinook HC6s and upgraded Puma HC2s, plus the Royal Navy's

AgustaWestland Lynx Wildcat HMA1s. All but one of the air force's Pumas have been modified to the new standard, and two from a planned three have been deployed to Afghanistan.

Meanwhile, AgustaWestland has inducted the initial batch of seven Merlin HC3/3As into its Yeovil facility in Somerset for conversion to the new HC4 standard for use by the RN's Commando Helicopter Force. These will be delivered in early 2016, with an avionics upgrade to follow.

Manufacturers are also considering a request for information issued by the MoD last November

covering the replacement or upgrade of the British Army's fleet of Boeing/AgustaWestland AH-64D Apache AH1 attack helicopters. The process is intended to allow it to field 50 aircraft configured to the new E-model standard.

"We will support whatever procurement policy [Defence Equipment & Support] deem appropriate," says Nick Whitney, director of business development for Boeing UK's defence business.

AgustaWestland is also keen to offer a solution, but declines to comment. A decision on the £1 billion (\$1.5 billion) programme is expected in early 2016. ■



**Boeing bids to keep  
777 line rolling  
COVER STORY P10**

**REGULATION MAVIS TOH SINGAPORE**

# Jakarta urged to up game on safety

Indonesia pressed by IATA boss to tackle high accident rate, improve infrastructure and manage traffic to handle growth

IATA has called on Indonesia to develop an aviation masterplan that will focus on three main issues: improving safety, ensuring capacity and introducing a smart regulation framework.

In his keynote address at the IATA Aviation Day in Jakarta, director general Tony Tyler said safety is a top priority for Indonesia, since the nation has seen at least one hull loss every year since 2010. The most recent incident – involving Indonesia AirAsia flight QZ8501 – killed 162 passengers and crew in an Airbus A320 crash last December.

Of 62 Indonesian airlines operating scheduled and charter services, only flag carrier Garuda Indonesia is on the IATA Operational Safety Audit (IOSA) registry.

“Making IOSA compulsory for an Indonesian AOC [air operators

certificate] will send a very strong signal of commitment to improve safety,” Tyler says. The nation’s traffic growth also needs to be supported by infrastructure on the ground and in the air, he adds.

Tyler is calling for the development of Jakarta’s congested Soekarno-Hatta International airport into a hub, saying this will require a major redevelopment of the airport’s terminal areas. Indonesia already has plans to build 62 airports over the next five years.

IATA has also highlighted issues in slot management processes at Indonesian airports, and says it is ready to assist with the introduction of professional and independent co-ordination, which would bring working procedures in line with global standards.

As Indonesian skies become more crowded – with more than



Rex Features

**The loss of flight QZ8501 was the latest in a string of crashes**

800 aircraft on order by its carriers – IATA is also urging it to improve the skills of air traffic controllers, implement performance based navigation and introduce air traffic flow management at airports.

“Indonesia’s aviation potential is huge. By 2034, it is expected to

be the sixth largest market for air travel. That’s three times the size of today’s market,” says Tyler.

“There is a big role for collective leadership among industry partners – including the government – to make the aviation sector flourish.” ■

**DEVELOPMENT KATE SARSFIELD LONDON**

## Second Flaris LAR-1 begins taxi tests

Polish engineering company Metal Master began taxi tests of its second Flaris LAR-1 prototype (MSN2) on 20 February, and is preparing the ultra-light personal jet for its debut flight.

During the 2h evaluation at Bydgoszcz airport in northern Poland, Metal Master tested MSN2’s Pratt & Whitney Canada PW610 turbofan engine, brakes and land-

ing gear during the acceleration and deceleration phases of taxiing. The aircraft reached a maximum speed of 55kt (100km/h).

Although the PW610 is being used during initial flight testing, the company has yet to disclose its final choice of engine for the €1.5 million (\$1.9 million) aircraft.

Metal Master plans to validate the five-seat LAR-1 initially under

the Polish civil aviation authority’s S-1 experimental aircraft designation. Deliveries are scheduled to begin in 2016, with a certified version approved to European CS-23 standards expected to follow in 2018. The type is projected to have a maximum take-off weight of 1,500kg (3,300lb), a cruise speed of 380kt and a range of 1,730nm (3,200km). ■



Metal Master

**Prototype MSN2 underwent evaluation of its turbofan engine, brakes and landing gear last month**

**MODIFICATIONS**  
**DAVID KAMINSKI-MORROW**  
LONDON

## BA tests water with sharklet fit for A320s

British Airways will retrofit some of its Airbus A320s with “sharklet” wing-tips to “reduce fuel burn and increase efficiency”.

The carrier has yet to confirm when the retrofit – initially involving 10 of its newest A320s – will begin, but hints it will start the work in the next few months.

The most recent A320s’ wings already meet the production standard required to accommodate the modified wing-tips. Airbus has also started offering a retrofit for older examples, which involves wing reinforcement.

BA has no immediate plans to extend the retrofit beyond the first 10 jets. The carrier has been involved in a broader scheme to save costs on its A320s by harmonising core specifications for avionics, galleys and cabin crew seating. ■



**PRODUCTION STEPHEN TRIMBLE PHOENIX**

# Boeing bids to keep 777 line rolling

New model is selling well, but challenge is finding enough orders for current large widebody to bridge production gap

**B**oeing has unveiled the details of performance and interior upgrades aimed at keeping its 777 assembly line at full rates through to at least 2017, including attracting 40-60 new orders this year.

Airbus and Boeing have attracted massive order backlogs in the last few years, but most of the orders are for new or re-engined models that have not yet entered service.

Keeping backlogs filled for existing assembly lines has not been so easy, especially for widebody aircraft. Last month, Airbus announced that the A330 production rate will fall a second time from nine to six aircraft per month, down from 10 per month a year ago. Any further reductions in rate could make it harder for Airbus to ramp up production of the re-engined A330neo in three years.

## PRESSURE

Boeing is under similar pressure to keep building 777s at a rate of 8.3 per month or about 100 per year through the transition to the 777X. The first 777-9X bound for the flight test fleet enters the assembly line in 2018, a critical year of transition for the programme.

An analysis of Flightglobal's Ascend Fleets orders database suggests Boeing still has some work to do. The database shows about 15 unsold positions in 2016, but about 65 unclaimed production slots in 2017. Factoring in normal production lead times, that gives Boeing about 18 months to sign up to 80 orders for the 777, or face a rate cut decision.

"Our first focus was to fill the production line in 2016," says Boeing vice-president of marketing Randy Tinseth, speaking at the ISTAT conference in Phoenix, Arizona on 9 March.

"We're to the point we're essentially sold out [for 2016] now. I look at 2017, I look at options, I look at what's coming down the pipeline, I think we're



Seattle is under pressure to keep building 777s at a rate of 8.3 per month, or about 100 per year

well-positioned for 2017," Tinseth says. "We're especially excited that we're seeing movement in the cargo market."

Boeing still has several levers it could pull to bring in new orders. It can offer airlines that have ordered 787s to switch to more readily available 777-300ERs. That tactic is currently being pursued with United Airlines on a potential order conversion for up to 10 aircraft.

**"There is room for dedicated freighters, but more and more freight is moving in the bellies"**

**STEVEN UDVAR-HAZY**  
Chief executive, Air Lease

Attracting new orders from a resurgent cargo market is another option, as Tinseth suggests, but many doubt that this strategy will work. Although air cargo demand is trending upward for the second consecutive year, additional cargo volumes may not translate into a new wave of orders for dedicated freighters, such as the 777F.

More than 300 passenger-car-

rying widebody aircraft are entering service annually, each with significant space for belly cargo, says Steven Udvar-Hazy, chief executive of Air Lease. That supply has reduced demand for new freighter orders, he says. "There is room for dedicated freighters, but more and more of the freight is moving in the bellies," he says.

That leaves the passenger-carrying version to carry the load in Boeing's campaign to fill the production slots for the 777. As a result, Boeing has timed a performance upgrade package to appear in the third quarter of 2016, just as the current backlog begins to run dry.

The package includes a 1.5% improvement in fuel efficiency from aerodynamic "clean-ups" of the airframe, Tinseth says. Boeing, for example, is eliminating the tailskid and updating the fly-by-wire controls to prevent a tail strike from occurring. The slats on the leading edges of the wings will be made 60% thinner. Boeing also is improving the camber of the outer wing's trailing edge to make it more efficient. An update to the flight control software will allow the elevator to augment stabiliser trim to reduce drag.

Another one-half percentage improvement point will come from new updates to the GE90 engine. Drawing on advances from the GENx and GE9X programmes, GE Aviation has improved the efficiency of the blisk in the first stage of the high pressure compressor and tightening clearances between the shroud and the blades of the nozzle in the first stage of the low pressure turbine.

Finally, GE is re-introducing an improved core compartment cooling valve that had previously been removed from the GE90, due to reliability problems.

## IMPROVEMENTS

Despite those improvements, the 777 remains a tough sales challenge in an otherwise healthy orders market. Its biggest obstacle to gaining new orders may be a fundamental pricing issue. As AerCap chief executive Angus Kelly noted at the ISTAT conference, he and other lessors would have bought dozens of A330s if Airbus offered a steep price discount to fill the backlog. Airbus chose not to do so because, Kelly says, that could have slowed the uptake of its latest products, like the A330neo and the A350. ■



**PROGRAMME STEPHEN TRIMBLE PHOENIX**

# Average dispatch reliability for 787 rises 'above 98%

Figures for global fleet show improvement in Dreamliner's performance – but are still falling short of Boeing's target

Fleetwide dispatch reliability for the Boeing 787 programme has improved by about 0.5 percentage points over the past six months, according to Randy Tinseth, vice-president of marketing.

That improvement still falls short of the company's objective nearly three and a half years after the first 787-8 was introduced to All Nippon Airways.

Speaking at the ISTAT 2015 conference in Phoenix on 9 March, Tinseth says the fleetwide average is currently above 98%. Last September, an executive for a 787 operator told Flightglobal that

the fleetwide average was hovering around 98.3%. Tinseth declines to confirm that number, but says the current average is a half of a percentage point higher than six months ago, and still below 99%.

The 787 dispatch reliability rate has improved slowly since the type was introduced into service in 2011 with a series of operational problems.

Boeing's objective for the 787 has always been to match the reliability standard set by the 777 fleet within three years of entry into service, and that has been maintained at around 99.5%.

Dispatch reliability for the 787-8 initially suffered due to software glitches with the flight control system. The aircraft's electrical systems have also been a source of reliability problems. A widely-reported issue surfaced



Being

All Nippon Airways introduced the type three and half years ago

with the 787's lithium-ion batteries used to start the auxiliary power unit and provide stand-by power for the cockpit avionics.

The recent improvement in fleetwide reliability may not be the result of any specific updates or changes to the 787, says Tinseth. Instead, the improving trend may be driven by a new group of operators that are benefitting from the knowledge gained by the earliest 787 customers, he says.

Meanwhile, Colombian carrier Avianca says it would "take advantage" of a higher performance Boeing 787-9 if improvements are made to the aircraft.

"Boeing is trying to sell us the -9, as well as the lessors," fleet

management director Jose Yunda said at ISTAT. "We are analysing that option right now, because the point we face right now with the -9 is performance out of Bogota. If the performance improves, of course we will like to take advantage of that."

Avianca's primary hub at Bogota El Dorado International airport is 8,660ft (2,640m) above sea level, making aircraft performance important in order to avoid payload restrictions.

The carrier is able to meet its performance targets with the 787-8, which it configures with 250 seats. ■

**Additional reporting by Edward Russell**

**"Boeing is trying to sell us the -9, as well as the lessors"**

**JOSE YUNDA**  
Fleet management director, Avianca

**ACCIDENT GHIM LAY YEO WASHINGTON DC**

## 'Braking difficulties' contributed to MD-88 overrun

The crew of the Delta Air Lines Boeing MD-88 that overran the runway at New York LaGuardia airport on 5 March had struggled to keep the aircraft from veering left, and experienced braking difficulties, says the US National Transportation Safety Board.

In an investigative update, the agency also says the aircraft sustained significant damage.

The MD-88 was attempting to land during a winter storm after operating flight DL1086 from Atlanta. It overran Runway 13 and came to a stop with its forward fi-

selage atop a berm and its nose jutting over the berm above the waters of Flushing Bay. Twenty-three of the 127 passengers on board sustained minor injuries.

The flight's crew decided to land based on reports of good braking actions from air traffic control, says the agency. Another Delta MD-88 that landed on the same runway before DL1086 confirmed that air traffic controllers relayed the braking action reports to flight crew of DL1086. These reports were based on two earlier flights that reported braking action on the runway as "good".

Citing interviews with the crew, the NTSB says the crew reported that "the runway appeared all white when they broke out of the

overcast, moments before landing". The aircraft's autopilot was engaged until it was about 230ft above the ground. On final approach, it had an airspeed of about 140kt (259km/h) and touchdown took place at about 133kt, according to preliminary data from the aircraft's flight data recorder.

The aircraft's automatic spoilers did not deploy but the first officer quickly deployed them manually, the agency adds. In addition, the MD-88's automatic brakes were set to "max", but the crew did not sense any brake deceleration.

"The captain reported that he was unable to prevent the airplane from drifting left," says the NTSB. ■



The aircraft stopped at LaGuardia with its nose over Rushing Bay

Twitter



FLEET DAVID KAMINSKI-MORROW LONDON

## Dash 7s make way for Dash 8s at Air Greenland

Air Greenland has sold its de Havilland Canada Dash 7 fleet to Canadian operator Trans Capital Air.

The airline had put its three Dash 7s – registered OY-CBU, OY-GRE and OY-GRF – on the market last year.

Trans Capital Air, based in Toronto, sent a party to Nuuk to inspect the aircraft in February.

Air Greenland chief Michael Højgaard says the Dash 7 is a “stable and robust” type but that the sale will enable it to modernise its fleet.

Two Dash 8 turboprops (OY-GRO and OY-GRP) are due to join the fleet in March and October this year, bringing the carrier’s total to seven.

These will be the “backbone” of its domestic flight operations, Air Greenland states.

Højgaard says the Dash 8 is less expensive, in terms of spares, and generates a 25% saving in fuel.

The two aircraft being delivered this year will also have higher fuel capacity, for longer-range services. ■

**The three aircraft were put on the market last year**



Rex Features

PROPELLION STEPHEN TRIMBLE PHOENIX

## CFM set to make Leap to higher rates

GE Aviation-Snecma joint venture prepares for major production increases with upgrades to engine assembly processes

As pressure grows to raise already peak production rates for single-aisle aircraft, CFM International has decided to roll out two major upgrades to the production system for the Leap engine series.

The joint venture of GE Aviation and Snecma will automate the quality inspection process and integrate a final assembly process that includes both pulsed and articulated features, CFM chief executive Jean-Paul Ebanga told the ISTAT conference in Phoenix, Arizona on 9 March.



**Quality inspection of CFM's Leap engines will be automated**

“We are facing a massive production ramp-up and we have to deal with that successfully,” Ebanga says.

With CFM the sole-source supplier for the Boeing 737 Max and the Comac C919 and offering a competitive option on the Airbus A320neo, the three versions of the Leap-1 series have already attracted orders for 8,600 engines.

Airbus and Boeing have committed to increase production on the A320neo to 50 per month and on the 737 Max to 52 per month within the next two years, pushing CFM’s annual output of 1,500 engines today to about 1,800 by 2020, Ebanga says. That ramp-up includes a transition from the CFM56 series to the Leap series over that time period, he adds.

At the same time, Airbus and Boeing are considering even further increases in production, with Airbus studying a ramp-up to 60 A320neos per month and Boeing acknowledging potential capacity to build as many 63 737 Max aircraft per month.

“We have our best customers who are asking us to go higher and faster,” Ebanga says.

CFM previously announced plans to expand production capac-

ity by investing \$800 million to add more than 140,000m<sup>2</sup> (1.5 million ft<sup>2</sup>) of manufacturing space at seven major new facilities unveiled within the last three years.

**“We have to successfully deliver all those engines. We are focusing on the main issue, one at a time”**

**JEAN-PAUL EBANGA**

Chief executive, CFM International

The next step CFM is taking is to improve how it assembles and inspects engines as it transitions to the Leap series, Ebanga says. In addition to modifying the assembly process, optical-based inspection machines will replace “human quality-control activities”, he says.

With more than 70% of the single-aisle engine backlog, CFM is most affected by any changes in production rate by Airbus, Boeing and Comac.

Pratt & Whitney supplies the PW1100G-JM engine for the A320neo family, as well as similar geared turbofans for several

other platforms, including the Bombardier CSeries, Embraer E-Jet E2, Irkut MC-21 and Mitsubishi Regional Jet.

“We’re partnering with our supply base, partnering with our logistics teams,” says Rick Duerloo, P&W vice-president of sales and marketing. “I can tell you right now we are ready for this ramp-up. No question.”

Ebanga calls the production increase over the next five years the key issue facing the industry, suggesting CFM may wait to match a 2% fuel efficiency improvement announced by P&W last year until the ramp-up is addressed.

“We have this huge ramp-up we never saw before,” he says. “We have to deal with that. We have to successfully deliver all those engines. We are focusing on the main issue, one at a time. There will be a time to upgrade our engines and we will do it.”

CFM has completed more than half of the certification testing on the Leap-1A engine for the A320neo, Ebanga says. That version of the re-engined aircraft is due to enter service in 2016, following the introduction of the PW1100G-JM-powered A320neo in the fourth quarter. ■



**USAF broadens horizons in hunt for JSTARS successor**  
**DEFENCE P15**

## AIR TRANSPORT

PROGRAMME STEPHEN TRIMBLE PHOENIX

# CSeries past half-way mark as flight test targets are hit

With type heading to certification, manufacturer vows it will keep promises on performance

The CSeries programme has passed the midway point of its test programme, with four to 10 months remaining before a scheduled entry into service, Bombardier's top salesman says.

Four CS100s and one CS300 now in flight test have accumulated more than 1,100 flight test hours, said Ross Mitchell, Bombardier's vice-president of business acquisition, on 9 March at the ISTAT conference in Phoenix.

"We are most of the way through the programme," Mitchell says.

The flight test hours have been accumulating rapidly since the test fleet returned in September from a 100-day hiatus caused by an engine malfunction.

At the time of the 29 May grounding, the test fleet had amassed about 300 flight test hours after eight months of testing.

In the six months since return to flight, the five test aircraft have completed at least 800 test hours.

Bombardier originally said the CS100 certification programme would consume about 2,400 flight test hours. Last month, executives said that number was a guideline rather than a specific target.

That estimate of 2,400 flight test hours includes a percentage



Bombardier

One CS300 and four CS100s have racked up 1,100h of flight tests

that will be completed on a ground-based simulator, Mitchell says. Bombardier has commissioned the integrated systems and test certification rig in Mirabel, Canada, to gain credit with Transport Canada for a certain number of flight test hours. By including the credit from the simulations, the CSeries test programme is now past the midway point, Mitchell says.

Moreover, the tests completed so far are more likely to have raised issues that could cause further delays, he says.

Entry into service in the second half of 2013 represents a delay of about two years compared with Bombardier's original schedule.

Despite that delay, the aircraft design appears to be performing

successfully in flight tests so far, Mitchell says. The company's original performance targets – including a 15% reduction in specific fuel consumption and a range of nearly 3,000nm (5,560km) – are being met, based on testing results, he says.

"We are going to meet everything we said. We're going to hit the range targets. We're going to hit the payload/range targets. We are going to give you the cost we said we would," Mitchell says. "We are going to save airlines a lot of money when they get this airplane. We may not be on time but we made a promise and we're keeping it." ■

**See next week's Canada country special for an update on Bombardier and the CSeries**

## AVIONICS

Rockwell Collins maps out global tracking system

One year after the disappearance of Malaysia Airlines flight MH370, avionics company Rockwell Collins has announced it has developed a system that can help airlines cost-effectively track aircraft nearly anywhere around the globe.

Key to the new system, called ARINC MultiLink, is its ability to collect position data from a patchwork of six different sources.

Those include position information from air navigation service providers and data from aircraft communications addressing and reporting systems, automatic dependent surveillance-broadcast systems and automatic dependent surveillance-contract systems, Collins says.

In addition, the company says MultiLink can process data from Collins' air-to-ground high-frequency data link (HFDL) system. Collins says it has modified HFDL, which formerly primarily transmitted non-real-time aircraft data for maintenance purposes, so that it can transmit real-time position data, including in remote regions of Asia.

MultiLink merges the data, which can then be sent directly to airlines or incorporated into other Collins products, it says. ■

 Keep track of the latest news regarding the missing airliner: [flightglobal.com/MH370](http://flightglobal.com/MH370)



Airbus

## WIDEBOODIES

### Heavy Delta A330-300 shows colours

Airbus has released photographs of its first higher-weight variant of the A330-300 in the colours of Delta Air Lines.

The manufacturer rolled the aircraft out of its Toulouse paint shop about four months after the airframe entered final assembly and less than two months after making its first flight.

The higher-weight A330-300, which shares the same platform as Airbus's in-development A330neo, has a maximum take-off weight of 242t and is powered by General Electric CF6-80E1 engines.

The aircraft, which can fly an additional 500nm (926km) and is up to 2% more fuel-efficient, can operate flights as long as 15h, Airbus says.

Delta has orders for 10 A330-300s, 25 A330-900neos and 25 A350-900s, according to Airbus.



**RECONNAISSANCE**  
BETH STEVENSON LONDON

## Sentinel set to bolster coalition over Iraq, Syria

At least one of the Royal Air Force's Bombardier Global Express-based Raytheon Sentinel R1 surveillance aircraft is due to be deployed to an undisclosed location in the Mediterranean, suggesting that it is being positioned to join the coalition operation against Islamic State militants in Iraq and Syria.

Assets including Panavia Tornado GR4s, Boeing E-3D airborne warning and control system aircraft and an Airbus A330 Voyager tanker/transport are currently operating from RAF Akrotiri in Cyprus – also the likely location for a Sentinel deployment, should the type join the UK's "Operation Shader" activity.

The launch and recovery location for its General Atomics Aeronautical Systems MQ-9 Reaper unmanned air vehicles – which have so far amassed 4,000 flying hours during the operation – has not been disclosed.

The suggestion that Sentinel will be committed to the US-led campaign has been backed by a senior RAF commander, who told Defence IQ's Airborne ISR and C2 Battle Management conference in London that the aircraft would be a natural choice.

Following the return of two Sentinels from their participation in a three-week Red Flag-series exercise at Nellis AFB in Nevada last month it is understood that all five RAF examples are currently in the UK.

According to the UK's 2010 Strategic Defence and Security Review, the battlefield reconnaissance type had been due to exit service this year, but additional funding confirmed last July will extend this until at least 2018.

A redeployment of the RAF's first Boeing RC-135W Rivet Joint signals intelligence aircraft is also expected, while 51 Sqn's second of three examples is also due for delivery in mid-2015, slightly ahead of schedule. ■

**ROTORCRAFT DOMINIC PERRY LONDON**

## AW101 ready for counter-mine trials

Japan's Maritime Self-Defence Force has received the first AgustaWestland/Kawasaki Heavy Industries MCH-101 helicopter configured for the airborne mine countermeasures role. A licence-produced version of the AW101

built at Kawasaki's Gifu factory, the new variant is equipped with Northrop Grumman's AQS-24A airborne mine-hunting and AES-1 laser mine detection systems.

Development of the model has been led by Kawasaki, including



AgustaWestland

Kawasaki fitted the AQS-24A deploy, tow and recovery system

integration and design of the AQS-24A carriage and its deploy, tow and recovery system. AgustaWestland has provided technical support, including modification of the helicopter's automatic flight control system.

Following delivery on 27 February, the MCH-101 has been transferred to the service's 51st Experimental Sqn for evaluation trials. It is due to enter operational service in 2016.

Flightglobal's Ascend Fleets database records Japan's navy as having taken delivery of six MCH-101 airframes so far from a total order for 11, as well as two of an eventual three CH-101 utility transports. ■

**AEROBATICS IGOR SALINGER BELGRADE**

## Croatian display pilots will break formation for Qatar

Members of Krila Oluje team tender their resignations following lucrative offer from Doha

Six of the Croatian air force's top instructor pilots – all of them members of the Krila Oluje ("Wings of Storm") aerobatic display team – have applied to resign from active duty.

According to sources quoted by local media, the pilots – ranked as captains and majors – have received a superior offer from Qatar. Croatian daily *Slobodna Dalmacija* reports that the Gulf state plans to form a display team with its new Pilatus PC-21 trainers, to include the Croatian pilots.

Submitted on 4 March, the resignation requests will be decided on "after consultation with the pilots and in accordance with law", Croatia's defence ministry says. Any departure "will not



Igor Salinger/Aermedia.com

'Wings of Storm', based at Zadar, perform using PC-9 trainers

compromise the combat readiness of the Croatian armed forces, namely the education and training segment within the Croatian air force", it adds.

The ministry notes that its pilots "have obviously opted for a much better [financial] offer that it could not match".

Croatia's display pilots are assigned to its Zadar air base, with the Krila Oluje team flying PC-9s.

Separately, Zagreb is expected to receive up to 16 Bell OH-58D

Kiowa helicopters, following a donation offer made by the US government. Import taxes linked to the acquisition are expected to total around HRK100 million (\$14.1 million).

The ex-US Army rotorcraft would be delivered without armaments, but with their mast-mounted sights still installed. A related weapons package will be requested once funding can be secured, but no sooner than 2018. ■

**"The pilots have opted for a better offer than the ministry could not match"**

**CROATIAN DEFENCE MINISTRY**



**Singapore reveals  
Super Puma  
replacement plan**  
**DEFENCE P17**



#### HELICOPTERS

## First flight edges Ka-52K towards maritime debut

Russia has conducted the first flight of a Kamov Ka-52K attack helicopter, with the maritime type having made a 40min debut on 7 March.

Adapted from the Ka-52 "Alligator" for deployment aboard the Russian navy's future Mistral-class amphibious assault ships, the new variant features folding rotors and folding stub wings.

Flightglobal's Ascend Fleets database records the Russian navy as having signed a firm order for four Ka-52Ks, with options to increase this by a further 28 aircraft. The programme has been subject to delays, however, with a first flight target initially having been set for mid-2013.

France late last year halted the planned delivery of the service's first of two ships, the *Vladivostok*, due to Moscow's part in shooting down a Ukrainian plane.

Russia has previously conducted ship-based trials in support of the K-model development using its air force's Ka-52 variant. Ascend shows the service as having 63 Alligators in use, with another 93 on order. ■

**Boeing is offering a 737-based system as a replacement for the service's current E-8C fleet**

**CONTEST DAN PARSONS WASHINGTON DC**

## USAF broadens horizons in hunt for JSTARS successor

Requirements dictate use of smaller airframe, with international types to be considered

The US Air Force will consider domestic and international airframers to replace the Northrop Grumman E-8C JSTARS fleet, according to documents released on 5 March, which also confirm the service's preference for a smaller aircraft than the Boeing 707-based type.

Requirements are for a "smaller, more efficient airframe, thereby reducing life-cycle costs of the weapon system", the USAF says. Its selected platform must come complete with a JSTARS battle management, command and control system and synthetic aperture

radar/moving target indication capability, it adds.

"The JSTARS Recap Program Office will contract for the delivery of a complete integrated weapon system solution, as opposed to holding separate competitions for individual weapon subsystems for subsequent integration," the air force says. Also required are systems with high technology readiness levels and open architecture.

The decision to accept international competitors opens the process to manufacturers including Airbus, Bombardier – whose Global 6000 and in-development

Global 7000 business jets could fit the bill – Dassault and Gulfstream.

A previous attempt to replace the E-8C with a Northrop solution based on the 767-400ER was cancelled due to high costs.

Competitors already include Boeing, which is offering a 737-based system, a Gulfstream proposal based on the G650 and a Northrop offering using the G550. Lockheed Martin has joined Raytheon and L-3 Communications for the contest, but was waiting for the USAF to decide what size aircraft it prefers before confirming a platform choice. ■

**UNMANNED SYSTEMS BETH STEVENSON LONDON**

## Neuron heads for Italy as Dassault completes tests

Testing of the pan-European Neuron unmanned combat air vehicle demonstrator is set to move to Italy, following the completion of French assessment of the aircraft.

Following 100 test flights by Dassault, during which the sensor, datalink and stealth characteristics of the demonstrator were tested, responsibility for the six-nation Neuron aircraft will be transferred to Alenia Aermacchi. A later programme phase will see further testing performed in Sweden, by Saab.

All French tests were authorised by the nation's DGA defence procurement agency, and showed "exemplary" availability and reliability throughout, Dassault says. The first phase of tests



**The UCAV demonstrator performed 100 flights in French airspace**

involved the opening of Neuron's flight envelope – including opening its weapons bay door – as well as electro-optical sensor and datalink performance validation.

During a second phase, "most flights were dedicated to infrared and electromagnetic signature/

detection confrontations against operational systems", Dassault says, adding that these "produced all the expected results".

"This success demonstrates Dassault Aviation's know-how in strategic technologies and prime contractorship, as well as its abil-

ity to lead programmes involving European co-operation," it says.

Neuron carried out its first flight in December 2012. Greece, Spain and Switzerland are also involved in the demonstration effort.

Dassault is also involved in the Anglo-French Future Combat Air System (FCAS) project, with BAE Systems, to design a UCAV under a contract from the French and UK governments. A two-year feasibility study was launched last November, for which Dassault is expected to utilise some of its experience from the Neuron effort.

"Stealth-related data and feedback [from Neuron] will serve as a reference for future aircraft projects," it says. ■



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**Solar Impulse 2:  
flight to energise  
the aviation world**  
**NEWS FOCUS P18**

**CAPABILITY** GREG WALDRON SINGAPORE

## RAAF tanker fleet set for boom time

Canberra removes KC-30A from 'Projects of Concern' list following successful remediation work on aerial refuelling system

Australia has removed the Airbus A330 multi-role tanker transport from its 'Projects of Concern' list, following the successful completion of remediation work related to the type's aerial refuelling boom.

Designated the KC-30A in Australian service, the type has been on Canberra's watchlist since February 2010 owing to a number of project delays, with extensive work having been undertaken by Airbus in Spain related to the capability.

"Resolution of this [boom] issue completes the remediation of all activities identified in the project's remediation plan, and it has been removed from the list," says Harry Dunstall, acting chief executive of Australia's Defence Materiel Organisation (DMO).



The service has already taken delivery of five modified A330s

The Royal Australian Air Force operates five KC-30As, with one currently deployed to the Middle East to support US-led efforts against Islamic State insurgents in Iraq. The type has so far refuelled Australian and coalition aircraft using its under-wing hose-and-drogue pods.

"The recent acceptance of the boom capability paves the way to begin introduction of boom inflight refuelling into service through 2015," the DMO says. "This capability will now undergo operational evaluation."

By 2023, only 36 of the RAAF's aircraft will still use hose-and-

drogue refuelling, counting 24 Boeing F/A-18F Super Hornets and 12 EA-18G Growlers. Another 100, including the Lockheed Martin F-35, will require boom refuelling.

Flightglobal's Ascend Fleets database records four of the service's KC-30As as being in current active use with Amberley, Queensland-based 33 Sqn.

Speaking at last month's Avalon air show near Melbourne, Air Cdre Warren MacDonald said the KC-30A fleet is expected to accumulate a combined 4,500 flight hours this year. The type has already logged in excess of 1,300h in the Middle East since being deployed to the region late last year as part of Australia's operation "Okra" commitment, he adds. ■

**REQUIREMENT** GREG WALDRON SINGAPORE

## Singapore reveals Super Puma replacement plan

Defence minister Ng Eng Hen has announced plans to replace Singapore's air force fleet of 32 Airbus Helicopters AS332 Super Puma and AS532 Cougar rotorcraft over the next 10 years.

"Our Super Puma helicopters have been in service for almost 30 years," Ng said in a speech to the nation's parliament. "They will need replacements, and this will occur over the next decade."

Ng made no mention of the number of airframes to be obtained, but it is believed that the fleet acquired could be substantially lower than at present – perhaps half the current total. It is not clear whether a request for proposals has

been issued for the requirement, or which manufacturers could be interested in bidding.

Although Singapore's Super Pumas and Cougars are well

maintained, industry observers say the ageing airframes are likely to impose a substantial maintenance burden, particularly given high utilisation rates and the na-

tion's hot, humid climate.

A newer, more maintenance-friendly aircraft would allow it to operate fewer airframes.

A replacement contest could attract interest from manufacturers such as AgustaWestland, Airbus Helicopters, Bell Helicopter and Sikorsky. At the 2014 Singapore air show, Bell Boeing also demonstrated the V-22 Osprey tiltrotor, but Singapore may not need such a significant enhancement in its rotorcraft capabilities.

Flightglobal's Ascend Fleets database records the Republic of Singapore Air Force's AS332/532s as having been delivered between 1985 and 1993. ■



Deliveries of the AS332 to the nation's air force started in 1985

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TECHNOLOGY DAN THISDELL LONDON

# Solar Impulse 2: flight to energise the aviation world

Swiss pilots of record-breaking solar-powered venture say they are flying to raise awareness of clean energy worldwide

**A**s an aviation record-setting machine, Solar Impulse 2 is off to a good start. Following a relatively short first leg of its round-the-world adventure – 400km (249 miles) from Abu Dhabi to Muscat, Oman in just over 13h, including a long holding pattern – stage two covered 1,468km in 13h 20min across the Arabian Sea to Ahmedabad in India, claiming the solar-powered world straight distance record for manned flight between pre-declared waypoints.

Subject to Fédération Aéronautique Internationale verification, the record will replace that set by SI2's predecessor aircraft in 2013 – a flight of 1,386.5km made during a barnstorming tour of the USA that formed part of the preparation for the round-the-world flight.

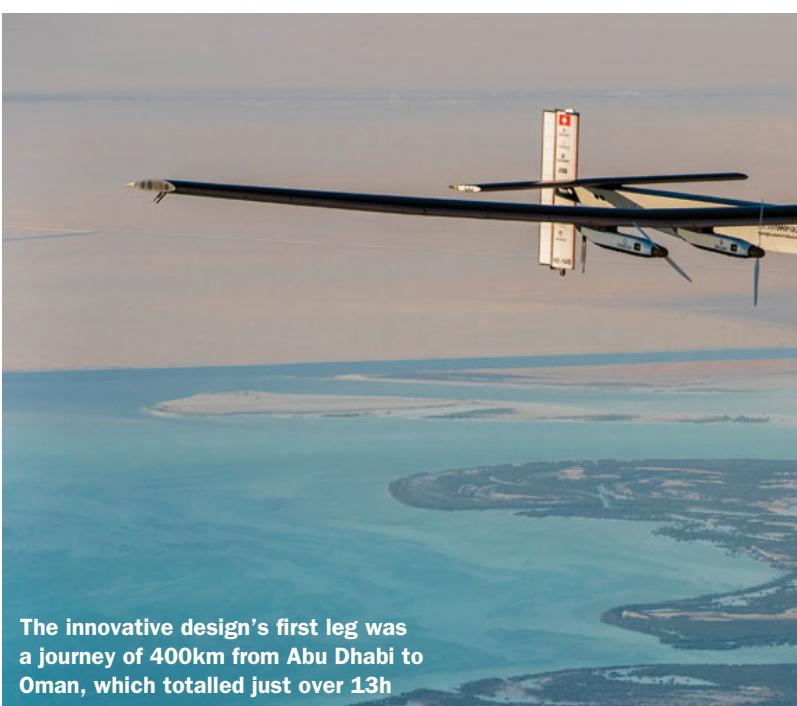
Project co-founders André Borschberg and Bertrand Piccard – both accomplished aviators – must be pleased to be making a mark in the aviation history books. Borschberg was at the controls during the now-eclipsed record and for the Abu Dhabi–Muscat leg, while Piccard flew the crossing to India. Both of them will have a chance to push

the endurance record further on upcoming legs across the Pacific and Atlantic oceans – their personal endurance will also be on test during those legs, which will take up to six days.

## TECHNOLOGIES

If all goes to plan and the 12-stage, 35,000km journey brings aircraft, Borschberg, Piccard and ground crew back to Abu Dhabi – possibly by mid-May – they will have achieved another first: girdling the globe in an aircraft powered exclusively by solar power. Technically, that “first” may remain up for grabs, as Solar Impulse 2’s route won’t take it across the equator. But by crossing the Middle East, India, China, two oceans, the USA and Europe, Borschberg and Piccard will have made their point.

That point – perhaps remarkably given the icon of this venture – is not about aviation: it is about energy. The pair hope that flying huge distances with about as much power as a small motor scooter will demonstrate that the world’s formidable energy challenges can be met by existing technologies. So, they will be using their time – and the mas-



The innovative design’s first leg was a journey of 400km from Abu Dhabi to Oman, which totalled just over 13h

sive presence of their aircraft – during all their stops along the way to hold press conferences and meet with governments, non-governmental organisations, universities and schools. As Piccard puts it: “With our attempt to complete the first solar-powered round-the-world flight, we want to demonstrate that clean technology and renewable energy can achieve the impossible.”

“Renewable energy can become an integral part of our lives, and together we can save our planet’s natural resources.”

## DREAMS

As Piccard recently told *Flight International* sister journal ICIS Chemical News: “The technological solutions that allow Solar Impulse to fly both day and night are accessible to all and are repli-

**“Clean technology and renewable energy can achieve the impossible”**

**BERTRAND PICCARD**

Co-founder, Solar Impulse project

cable in everyday life. These are not secret, futuristic technologies. If they were used routinely in our society, we would be able to save 50% of our consumption of fossil energies and to produce half of the rest with renewable energies.

“Solar Impulse wants to emphasise the energy solutions as well as the environmental and political solutions from a decidedly constructive angle in order to engender enthusiasm and the necessary motivation to leave behind this pervading fatalism. Aviation makes you dream, feeds your passions.”

Grand vision aside, Solar Impulse 2 is a remarkable achievement from a purely aviation perspective, whether it ultimately completes its global tour as planned or not. The single-seat aircraft has a wingspan of 72m (a Boeing 747-8I comes in at “just” 68.5m), but weighs a mere 2,300kg (5,070lb) – about the mass of a car – including its 633kg load of lithium batteries and the 17,248 solar cells on its



The single-seat aircraft has a wingspan of 72m – wider than a 747-8I – but weighs a mere 2,300kg

Solar Impulse



**First Brazilian G280 ready for delivery**  
BUSINESS AVIATION P20



ropean Space Agency for “invaluable” expertise in batteries and solar cells, energy management systems and ultra-lightweight materials. As Borschberg told Flightglobal during the Solar Impulse 1 campaign, the project is truly a bid to show the world that it can solve its formidable environmental challenges with technologies that are available today.

#### EFFICIENCY

As he said at the time, only two of Solar Impulse’s technology partners were in aviation: Dassault and Germany’s DLR research agency. The others are about meeting the project’s energy efficiency demands.

But separating Solar Impulse as an aviation project from Solar Impulse the energy efficiency project is probably impossible. Flying on solar power alone is ultimately possible only by driving aircraft weight down to an absolute minimum while maximising mechanical and aerodynamic efficiency. As such, Borschberg and Piccard’s aircraft should trace its DNA to the pioneering days of human-powered flight in the 1970s.

The roots of Solar Impulse can be seen clearly in AeroVironment founder Paul MacCready’s 1977 Gossamer Condor – the first human-powered aircraft to demonstrate take-off, controlled flight and landing – and his Gossamer Albatross, which two years later captured the public imagination with a pedal-powered crossing of the English Channel, a feat in no small way assisted by the pioneering use of then-exotic carbon fibre construction, which got the aircraft mass down to a mere 32kg.

A decade later, Massachusetts Institute of Technology and NASA researchers pushed efficiency further with Daedalus, named after the mythical Greek with wax-and-feather wings. A real Greek cycling champion piloted the machine from Crete to Santorini in 1988 – at nearly 4h and just short of 200km, the endurance records stand to this day.

MacCready went on to create what was essentially a solar-powered version of Albatross, Gossamer Penguin, and then Solar Challenger – an aircraft whose configuration presaged Solar Impulse, and which in 1981 set the world record for the highest, farthest and longest solar-powered manned flight with a 260km, 5h 23min trip from Corneille-en-Verin airport, north of Paris, across the Channel to RAF Manston. Built as a demonstrator for solar power and advanced composite materials, the airframe and solar propulsion system weighed only 93kg and was designed for a 9g ultimate load factor.

#### POTENTIAL

As with any of these projects, Solar Impulse should not be judged in terms of its direct commercial potential in aviation, though spinoff technologies are already making their way into marketable applications, and no doubt will eventually feature on commercial aircraft. Rather, its value is in its message, and while the power consumption gap between Solar Impulse and any commercial aircraft is a yawning chasm, in this energy-challenged world it is a gap that the wider aerospace industry should address with some urgency. ■

horizontal surfaces. The materials and assembly techniques that make such a lightweight structure possible, combined with the solar power harvesting and electronics needed to keep the aircraft flying day and night, may not be of direct use to engineers working on “normal” aircraft – but the extraordinary efficiency of Solar Impulse can only be inspirational.

#### TEMPERATURES

Flying at altitudes of almost 27,900ft and speeds of between 27–54kt (50–100 km/h) makes the trip a series of long hauls for the pilots – especially as they are doing it in a single-seat cockpit of just 3.8m<sup>2</sup>, neither heated nor pressurised and subject to external temperatures ranging from -40°C to +40°C.

Critical to survival under such conditions are some of the most exotic structural materials in use today. Bernd Rothe, the Solar Impulse project manager at one of its sponsors, Bayer MaterialScience, describes the design of the

cockpit shell as a “major” insulation challenge, met by a Bayer-developed rigid polyurethane foam that is also being used to keep the batteries warm, and has been pushed into the automotive and refrigeration industries.

Elsewhere in Solar Impulse 2, Bayer supplies a carbon nanotube-reinforced epoxy resin that dramatically improves the mechanical properties of the carbon-fibre-reinforced plastic – including some in the “paper thin” sheets that make up much of the aircraft’s structure.

The pilots are also high-tech. To endure long stretches in the air, Borschberg and Piccard are employing state-of-the-art approaches to diet, and techniques including self-hypnosis, micronapping and yoga. The Payerne, Switzerland-based duo are in any case well-suited to the task. Piccard is a medical doctor whose aviation pedigree includes the 1985 European aerobatic hang-gliding title and captaining the 1999 Breitling Orbiter non-stop round-the-world balloon flight. Borschberg is a mechanical engineer, a former Swiss air force pilot, consultant and entrepreneur.

The project got going in late 2003, with feasibility studies at Switzerland’s Ecole Polytechnique Federale de Lausanne; Solar Impulse also credits the Eu-

**The cockpit shell was a “major” insulation challenge met by a Bayer-developed rigid polyurethane foam**



**Daedalus set the human-powered flight record of 200km in 4h**



CERTIFICATION KATE SARSFIELD LONDON

## First Brazilian G280 ready for delivery

Gulfstream is poised to deliver the first Brazilian-owned and registered G280 business jet, following validation of the super-midsize type earlier this month by the country's civil aviation authority, ANAC.

Gulfstream says it has delivered more than 50 G280s since the aircraft entered service in November 2012.

"It has proven popular around the world," the company says. It is now certificated in countries including China, Mexico and the USA, and across Europe and South America. "This aircraft is particularly well suited for Brazil," says Gulfstream president



Gulfstream

**Gulfstream has delivered more than 50 of the type since 2012**

Larry Flynn. "From São Paulo, the G280 can reach the entire continent without refuelling and can fly to Europe with one stop."

The Honeywell HTF7250G-powered G280 has a range of 3,600nm (6,670km) at Mach 0.80 with four passengers.

Demand for Gulfstream's mid-size family – also including the smaller G150 – is rising. In 2014, the General Dynamics-owned company delivered 33 models, 10 more than the previous year, and plans to ramp up midsize jet production by a third in 2015. ■

ENGINES KATE SARSFIELD LONDON

## GE puts Passport in Kansas

Manufacturer to invest \$7 million in facility for powerplant slated for Bombardier Global jets

GE Aviation has selected its Strother, Kansas facility as the manufacturing base for its new Passport engine, which will power Bombardier's in-development Global 7000 and 8000 ultra-long-range business jets.

The US company says it is investing \$7 million in machinery at the 64-year-old site, which is currently a service centre for the CFM56, CF34, T700 and CT7 airliner and helicopter engines.

The funding will support the engine assembly and create maintenance, repair and overhaul

(MRO) provision for the 16,500lb (73kN)-thrust powerplant.

"This investment will position Strother to play a pivotal role across the entire life cycle of the Passport engine," says Tony Aiello, GE Aviation's vice-president and general manager, assembly, test and MRO operations.

GE says it will install equipment and train employees on the engine assembly line this year, and expects to roll the first Passport engine off the assembly in 2016.

The Passport powerplant made its first flight late last year

on GE's 747-100 flying testbed, based in Victorville, California. As of 1 March the programme had notched up 1,000h and 500 cycles.

Bombardier is counting on GE to certificate the Passport engine by the end of 2015. It can then join a certification programme for the first 7,300nm (13,500km)-range Global 7000, which is scheduled to enter service in 2016.

The 7,900nm-range Global 8000 is earmarked for service entry the following year. ■

AIRPORTS DOMINIC PERRY FARNBOROUGH

## Big jets boost traffic for TAG Farnborough airport

TAG Farnborough airport – the only dedicated business aviation facility in the UK – saw movements at the site, to the west of London, grow by just under 6% last year, despite potential disruption caused by the 2014 edition of the biennial air show in July.

Discounting the movements associated with the air show,

Farnborough still experienced a positive 2014, seeing traffic levels returning to pre-recession levels.

It was, says chief executive Brandon O'Reilly, "the highest number since 2008". Even during the air show, it saw "no discernible decline", he adds.

In all, TAG Farnborough recorded a total of 24,784 move-

ments, an increase of 5.6% over the previous year. However, analysis of the figures shows that the largest growth was in two categories of aircraft: airliner-derived business jets with a maximum take-off weight (MTOW) of up to 80t and ultra-long-range business jets, such as the Gulfstream G650, in the 30-50t MTOW class.

CHARTER  
KATE SARSFIELD LONDON

## Stratajet gives booking tool a \$5 million push

UK technology start-up Stratajet has secured \$5 million of investment to fund the roll-out of its real-time, online business aircraft booking platform across Europe in the third quarter, as well as its expansion into the US market.

Stratajet says the technology will shake up the business jet market by making online booking simple, clear, cost efficient and accurate. "We have been developing this software for five years," says Stratajet founder and managing director Jonathan Nicol. "We have been waiting to perfect the product before we formally launch it."

The pricing tool, called Stratafleet, takes into account "every single variable that affects price", including airport landing fees and airspace user charges. With this comprehensive data operators can provide "immediate and perfect quotations" to the end user through the Stratajet booking platform, says Nicol. The software also lists "real-time aircraft availability", he adds.

"This accurate and authoritative booking platform will not only help operators to increase their profit margins [by slashing the number of empty legs], it will also drive down the cost of charter for the customer," says Nicol.

Stratajet is set to embark on a four-month tour of Europe to promote its technology to operators and FBOs. ■

Movements in these categories recorded year-on-year growth of 8% and 5.7% respectively, says O'Reilly, and a 5% growth is expected this year.

Meanwhile, improvement works are continuing at the terminal as it looks to cater for increased passenger loads brought in by the bigger aircraft. ■



**SALES DAN PARSONS & STEPHEN TRIMBLE ORLANDO**

# Support offer was key to H175 order, says Bristow chief

Willingness of Airbus Helicopters to provide lifetime reliability agreement aided operator's decision to boost commitments

Offshore operator Bristow Group has more than trebled its commitment to the Airbus Helicopters H175, becoming the largest customer for the new super-medium rotorcraft with a total order of 17 units.

Bristow chief executive Jonathan Baliff says the company has struck a deal not only for the actual helicopters, but also for an "airline-style" comprehensive fleet support services agreement with the airframer, a deal virtually unprecedented in the rotary-wing segment.

The signing on 4 March at the HAI Heli-Expo show in Orlando, Florida, comes six months after Bristow called on manufacturers to follow the lead of commercial airlines and offer availability guarantees over a helicopter's life.

Both sides decline to confirm the terms of the support agreement, but Baliff says it "answers the call" Bristow made at the Helitech event in the UK. "This is a real big step forward for the Bristow Group," Baliff says.

Lifetime service guarantees are fairly common in the airline sector, but those aircraft seldom operate in conditions often seen by utility helicopters.

However, Bristow has identified such packages as key to its future

competitiveness, Baliff says. Months ago, Bristow announced that it would no longer "compete on safety". Rather than using the company's impressive safety record as a selling point to customers, Bristow decided to release all of its intellectual property regarding operational safety issues.

If safety is no longer a competitive advantage, Bristow would need to find a new strategy, and that pointed to the adoption of airline-style reliability agreements with manufacturers over the life of the products, Baliff says.

"As Bristow purchases helicopters in larger volumes, we look to partner with aircraft manufacturers who will step up to more comprehensive airline-style purchase and support agreements," he adds.

"We commend Airbus Helicopters for being the first partner to proactively share risk and responsibilities and commit to work closely with Bristow throughout the entire life-cycle of aircraft ownership."

Deliveries of Bristow's new H175s will begin in October 2016, with the aircraft configured for oil and gas support operations in a 16-passenger layout. ■

**Additional reporting by Dominic Perry in London**



Bristow's boosted order will make it the H175's biggest customer



Stephen Trimble/FlightGlobal

**Elytron will be able to switch between vertical and horizontal flight**

**INNOVATION STEPHEN TRIMBLE ORLANDO**

# US start-up takes radical approach for VTOL flyer

As a new era of high-speed rotorcraft unfolds, a California-based aviation start-up has unveiled another approach to solving the puzzle of vertical flight: a combination tilt-wing and joined-wing with propulsive pitch control.

The Elytron proof-of-concept vehicle, the design of Toulouse native Oliver Garrow, is scheduled to make its first flight in May or June, but it will be at least a decade before a production version is ready, he says.

Garrow's planned involvement is limited to demonstrating that the unique configuration can manage the transition from vertical to horizontal flight. If that goal is achieved, he will attempt to license the technology to a large manufacturer.

Garrow optimised the design to favour high-speed over vertical lift. The aircraft should have the power to hover, but the high disc-loading of the proprotor makes it inefficient. The extremely high lift-over-drag ratio of the joined-wing, however, should make the Elytron very efficient in forward flight, he says.

A "slippery" airfoil section on the wing also should make the aircraft faster than its planned rivals, he says. AgustaWestland describes the AW609 civil tiltrotor as having a forward speed of 275kt (508km/h), but a 10-seat version of the Elytron should reach up to 360kt, he believes.

"It's much more like an airplane that can do vertical mode than a helicopter that has wings," says Garrow. ■

**ENGINES KATE SARSFIELD LONDON**

# Continental offer for DA42 TDI

Diamond Aircraft has clinched European certification for a third engine to power in-service versions of its DA42 TDI turbo diesel piston twin. US approval for the four-cylinder, 114kW (155hp) engine is pending.

The Continental Diesel CD-155 will be available as a replacement for the 500 TAE Centurion 125-powered version of the four-seat aircraft.

Other retrofit options are the Austro AE300 – manufactured by Diamond's Austro Engines subsidiary – and the Lycoming

IO-360, although this option is only available through Diamond's Canadian facility in London, Ontario.

The FADEC-controlled CD-155 can run on either jet fuel or diesel, or any mixture of the two, according to Continental, at a rate of about 5 USgal/h (19litres/h).

The engine is approved for use with a three-blade variable-pitch propeller.

The DA42 TDI entered service in 2004. It was replaced five years later with the AE300-powered DA42NG, now called the -VI. ■



INVESTIGATION DAVID LEAROUNT LONDON

# Lack of evidence clouds MH370 report

Interim publication issued one year after Malaysia Airlines 777 vanished fails to cast fresh light on the mystery

**A**Malaysia-led multinational investigation team has published what facts it knows about Malaysia Airlines flight MH370, the scheduled Kuala Lumpur-Beijing flight that disappeared without trace on 8 March 2014. There are no conclusions about where it is or why it diverted from its flightplan.

The 587-page report, released by the minister of transport, summarises what is known about the missing Boeing 777-200 and its maintenance history. It also describes the flightpath it followed while it was in radar range, and what its track is believed to have been – based on satellite communications – beyond radar surveillance, until the time at which it would have run out of fuel.

If there are any real clues as to why the aircraft took the trajectory it did, they are to be found between the time the crew checked in for duty – 22:50 local time – and the time the aircraft could no longer be observed on radar, 02:22 local time the next day.

## NO CERTAINTIES

The deduction that the aircraft then turned south unseen is based on Inmarsat analysis of variations in satellite “handshake” exchanges with the aircraft – the only information available. But these were few, and the accuracy of any deductions drawn from them is not guaranteed. According to the sparse information available it seems probable that the search for the aircraft is being conducted in the best area, but there are no certainties.

After a normal departure from Kuala Lumpur to the northeast at 00:40 local time, climb to cruise went according to flight plan. At 01:19:26, Kuala Lumpur told MH370 to contact Ho Chi Minh air traffic control centre on frequency 120.9 MHz. After 4s the voice of the captain, Zaharie Ahmad Shah, replied: “Good night, Malaysia 370” – but he



Rex Features

**The deduction that the aircraft turned south is based on Inmarsat analysis of satellite exchanges**

did not read back the radio frequency, as he had done in a previous transmission. This was the last recorded radio transmission from MH370.

Just over 1min later, its Mode S transponder code dropped off the radar display – 5s after the aircraft had passed through waypoint IGARI, on the boundary between the Kuala Lumpur and Ho Chi Minh flight information regions (FIR).

**“We have followed the little evidence that exists. Malaysia remains committed to the search”**

**NAJIB RAZAK**

Malaysian prime minister

Slightly less than 9min later, Ho Chi Minh called Kuala Lumpur and asked where MH370 was, because the captain had not called the Vietnamese centre and the transponder return had been lost. Kuala Lumpur then contacted Malaysia Airlines’ operations centre, Hong Kong ATC and Phnom Penh ATC in Cambodia to solicit help in locating the aircraft.

Meanwhile, on military radar and Kota Bharu civil primary radar, the aircraft was seen to turn left near IGARI onto an almost reciprocal southwesterly track (231°M), and was tracked close to the FIR boundary all the way over the Malay peninsula into the Malacca Strait, coasting out just south of Penang. There it turned northwest, intercepting airway N571. The 777 followed the airway until 10nm (18.5km) beyond waypoint MEKAR, where it was lost to all radar coverage over the Andaman Sea at 02:22:12.

Following the diversion at IGARI, radar saw the aircraft’s flight level vary from the cleared cruise of FL350 (35,000ft) to a maximum of 35,700ft and minimum 31,100ft, with groundspeed fluctuations also.

This dramatic diversion from the flight’s planned route, combined with the flight-level fluctuations, would not be accounted for by a pre-programmed flight-management system taking over from an incapacitated crew. So if the diversion was deliberate, the question of motive arises, and the report looks into this issue.

“There were no behavioural signs of social isolation, change in habits or interest, self-neglect, drug or alcohol abuse of the

captain, first officer and the cabin crew,” the report says. “The CCTV recordings at KLIA [Kuala Lumpur International airport] on 7 March 2014 were evaluated to assess the behavioural pattern of the [pilots] from the time of arrival at KLIA until boarding time.”

## ANALYSIS

These recordings were compared with video of other departures by the same pilots, and the report states that there were no apparent behavioural changes. Checks on both pilots’ financial situation, insurance policies and health histories also yielded no clues that anything was abnormal.

While the report provides facts, it makes no attempt to draw conclusions. Unless the aircraft wreckage and its recorders are found, the causes of this extraordinary event will remain unknown.

Prime Minister Najib Razak says Malaysia is committed to finding the lost aircraft, with its 227 passengers and 12 crew. “Together with our international partners, we have followed the little evidence that exists. Malaysia remains committed to the search, and is hopeful that MH370 will be found.” ■



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BETH STEVENSON SAMLESBURY &amp; WARTON

**A**s the UK's largest remaining defence contractor, BAE Systems is in a state of flux, with its domestic market continuing to experience reduced spending, but the need to provide a sovereign capability remaining at a consistent high.

In order to keep a balance between intellectual property retention and revenue making, the company is refocusing the design expertise it has accumulated over decades of providing aircraft to the UK Ministry of Defence to emerging markets that have plans to develop indigenous systems.

"The main challenge we have is to try to work out how to sustain ourselves as a business," Michael Christie, director of strategy and market development for BAE's Military Aircraft and Information division, tells *Flight International*.

"There are two parts to sustaining us as a business; there's the self-centered motivation to keep something within the company, but there is also an element that is about sovereign capability."

"Production continuity is an issue," Christie notes. "It's slightly easier to stop production and restart than to stop design and restart it; stopping design – the skills erosion that would happen as a result of that would be hard to regenerate."

"Sustainment of our industry is really about sustaining the design capability, which is significantly harder. It is harder to start up and retain if you have a gap. So when we're looking at sustainment, we're looking at how we have continuity in our design capability."

Ongoing developments within the Military Aircraft and Information division include BAE's participation in Lockheed Martin's F-35 Joint Strike Fighter programme, through which it provides the horizontal and vertical tails, aft fuselage and wing tips for every aircraft produced. This gives it responsibility for some 15% of work on the Lightning II.

BAE delivered structures for 44 aircraft – with each consisting of one aft fuselage, two horizontal and two vertical tails – to Lockheed in 2014, and is targeting 48 in 2015. The programme is incrementally ramping up ahead of full-rate production in 2020, at which point 225 F-35s will be built per year. The programme should first hit the 100 aircraft per year target three years from now.

Jon Evans, head of operations for F-35 assembly at BAE, says that 180 aircraft must be built between 2015 and 2018, which equates to the total number of F-35s produced over the past 14 years.

This, he says, demonstrates the scale of production ramp-up that is under way.



## FRESH FRONTS

Amid tight military budgets in the UK and USA, BAE Systems is looking farther afield to ensure business is sustainable – while not abandoning its sovereign duty

BAE is currently carrying out its commitment to the JSF programme's eighth lot of low-rate initial production on a four-day turn-around per aircraft, and the 200th aircraft set is planned to be produced at its Samlesbury site in Lancashire in May.

In parallel to increasing the rate of production, the cost of each aircraft set also has to come down, in order for the Lockheed-led JSF team to meet its target of achieving an airframe unit cost of \$65 million for an F-35A by the time full-rate production is achieved. Combined with the aircraft's Pratt & Whitney F135 engine and other systems, the US joint programme office has set a goal of hitting an \$80 million price tag per conventional take-off and landing (CTOL) aircraft by 2019.

BAE has carried its experience in aircraft design through to its manufacture of parts for the F-35, with production tolerances set at within 1,000th of an inch so as to reduce the radar signature of the stealth aircraft, Evans says. This is all done at a consistent 21°C and is measured to within +/- 20 microns, which is the equivalent of a fifth of a human hair.

"It is even more important on the F-35 because it's designed as a stealth aircraft, whereas the [Eurofighter] Typhoon wasn't designed for stealth," Evans explains. "In comparison to the manufacture of Hawk and Typhoon, we're very automated, although BAE is upskilling people rather than just relying on technology."

By its own admission, BAE has gone from being one of the lowest performing suppliers



**BAE will use its experience from the Taranis UCAV demonstrator development in work with France**



**JSF production work is accelerating**

on the F-35 programme to what Lockheed has deemed one of the highest. This is due to a focus on controlling quality, affordability and efficiency.

The F-35 is being manufactured in three variants, and the production line at Samsbury is designed to deal with all three types.

The CTOL variant is currently the most repetitive, so is the easiest to move down the line as more have been built. BAE is, however, preparing for more work on the carrier variant F-35C – which has a larger and strengthened structure – as more orders for the type are made by the US Navy.

Although its F-35 participation is significant in terms of revenue and international exposure, Christie explains that from a design retention perspective, it is not going to make much of a contribution to adding to BAE's skill set.

## SKILLS

"F-35 – that sustained some capability, but it was focused on a few areas and you need to sustain all of the skill sets," he says. "And then that has an impact on sovereign capability – if the customer has a problem in a particular area you might just need every single skill set at some point."

The company is also carrying out a series of upgrades on the Typhoon, for which BAE is one of three industrial partners in the Eurofighter consortium, along with Airbus Defence & Space and Alenia Aermacchi. The programme is now entering its final Tranche 3A delivery phase, with fresh export sales needed to sustain it further.

"We are at the stage at the moment where we're developing the design on Typhoon, the design of which we started back in the 1980s, and if we had to design a new aircraft – be it a UAV [unmanned air vehicle] or manned aircraft – we'd have to bring to bear all of that skill from the 1980s."

In February, Eurofighter nations Germany, Italy, Spain and the UK signed a contract worth some €200 million (\$218 million) for a Phase 3 capability enhancement (P3E) package, intended to strengthen the type's multi-role credentials.

» One of the key elements of the work will be the full integration of the MBDA Brimstone 2 air-to-surface missile for the UK Royal Air Force.

This particular piece of work was contracted at a value of some £72 million (\$109 million) to BAE, which completed a feasibility trial linked to the enhancement in 2014.

Other elements of the P3E package include avionics upgrades, improvements to the Typhoon's mission system and maintenance equipment and capability enhancements related to its use of other weapons. These include MBDA's Meteor beyond-visual-range air-to-air missile and the standoff-range Storm Shadow cruise missile.

Full integration of the Brimstone 2 will enable the Typhoon to carry six of the weapons, which will be integrated using a pair of three-round launchers. The P3E standard is scheduled for delivery during 2017, with the upgrade "expected to be delivered into RAF service in late 2018", the UK Ministry of Defence says.

## RADAR

Last November, meanwhile, the Eurofighter partner nations agreed to support the development and integration of an active electronically scanned array (AESA) radar for Typhoon. The Euroradar consortium's Captor E-Scan will be incorporated under a €1 billion deal.

Until the point of contract, Euroradar partners had self-funded AESA development activities, including the installation of a Radar 1+ sensor and array repositioner in BAE's instrumented production aircraft IPA5, shortly before the Farnborough air show last July.

After making a show appearance, the radar was returned to Selex ES – one of the Euroradar partners – for the company to check its installation and additional power and cooling system performance.

BAE says that radiation hazard testing for the new radar is currently under way at its facility in Warton, Lancashire using a Tranche 1 Typhoon aircraft. It will then be returned to Edinburgh in Scotland, and should be flying by the end of 2015. BAE has modified the front and rear fuselage of the test aircraft so that it can carry the E-Scan radar.

Ahead of the release of the UK's new Strategic Defence and Security Review (SDSR) later this year, BAE is looking towards any sign of a big programme from the MoD.

"From a defence industry perspective, budgetary constraints in the UK and USA have required us to make significant changes to drive new efficiencies, which often leads to the need for tough decisions about our domestic footprint," BAE chief executive Ian King said during a Chatham House gathering in February.



**BAE is upgrading the Typhoon as part of its contribution to the Eurofighter consortium**

"The [SDSR] review provides a timely opportunity to consider the UK's defence and security requirements today and into the future. For industry, including my own company, decisions in the 2010 review led to painful adjustments, affecting the lives of many of our employees," King says.

"But it also gave us clarity, and more certainty for the following five years, including commitments to a number of major, long-term programmes that we are actively engaged on today."

King says that among arguments about defence spending, "it would be a mistake to assume the British public did not care about how we see Britain's place in the world".

## Budgetary constraints in the UK and USA have required us to make significant changes

**IAN KING**

Chief executive, BAE Systems

"As an absolute minimum we should be able to say that the UK customer is incredibly happy with what it's got," Christie says, claiming that just because the market is moving towards international deals, it does not take BAE's focus away from its home customer and making sure it is happy with its fleets.

"We're still very much dependent on the brand of the RAF. We work very closely with the RAF, and that brand of the RAF – whether it's the aircraft or the quality of the training that they provide – that is something we take to the market, and it's still a massive discriminator for us."

However, one of the key business concerns for BAE is collaboration, because it "will not stand alone" and has to be more internationalised. This, Christie says, comes in varying degrees, and some nations will more likely be design partnerships, while others will be

supply chain partnerships.

"All of our potential Middle Eastern customers are likely to be similarly demanding – they are going to want industrialisation. We're having to look at the shape of our supply chain going forward."

India is a good example of a market that BAE is moving further into, because it has the budget, but also a "bigger desire to indigenise the capability".

Turkey and the United Arab Emirates are other examples of growth markets, as they are countries with available budgets and a desire for industrial growth.

"We're looking to be excellent at doing that industrialisation, just as we are at making aircraft," Christie says. "We've moved away from the days where offsets were something you had to do just to get the contracts. It is now part of the requirement – we have to think of industrialisation even before we think of the aircraft."

Currently, 40% of BAE's business comes from the UK, with the rest coming from export activities, primarily from Saudi Arabia.

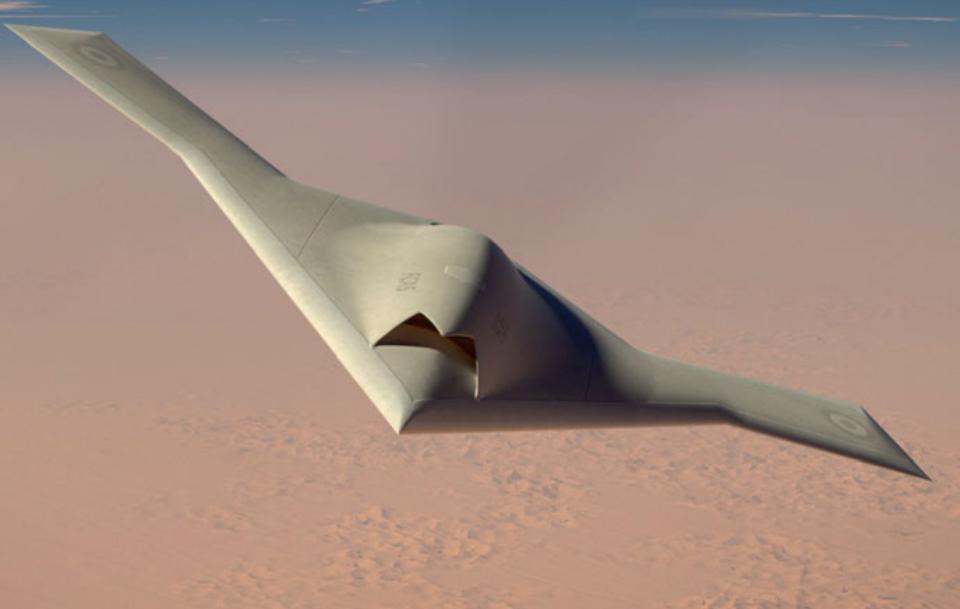
"As you go through the five- to 10-year plan, the UK goes down closer to 25%," Christie says. "Saudi remains large, but overall we have to generate significant new customers internationally."

"Predominantly that will be the Middle East. India will also be a big part – although at the moment it is predominantly Hawk, it is still a very big market for us."

"A lot of our long-term strategy is about how we find a long-term industrial partner in-country and develop and become an in-country entity," he says. However, the "UK is still absolutely key in terms of maintaining and regenerating intellectual property".

BAE is looking to India to see where sales for its Hawk advanced jet trainer will go.

During last month's Aero India show in Bengaluru, discussions took place between the company and Hindustan Aeronautics



Dassault

## The Anglo-French Future Combat Air System programme is a partnership with Dassault

(HAL) to identify what further work can be done in-country.

The Indian air force has operated the Hawk since 2008, following an initial order for 66 signed in 2004. This covered 24 aircraft to be built in the UK and 42 licenced to India for assembly by HAL.

A second contract, for 57 aircraft, was agreed on for the air force and navy in 2010, and BAE is in negotiations for a further 20, which would be used to equip the air force's Surya Kiran aerobatic display team.

### REQUIREMENTS

The key discussion remains around how to develop Hawk further in the region, and then work in partnership with HAL to sell more of the type, Christie says. The Indian company also used the Bengaluru show to reveal details of a cockpit upgrade for the trainer.

Also last month, Northrop Grumman announced that it had opted to offer a clean-sheet aircraft for the US Air Force's T-X trainer programme, rather than a modified version of the Hawk that it had originally planned to pitch in conjunction with BAE.

Development of the new aircraft by its Scaled Composites unit was already underway at the time of the revelation, with Northrop saying it would fly the new aircraft by the end of 2015.

"The Hawk is a tremendous airplane," Northrop said. "However, we decided as a team to offer a new design as the US Air Force continued to mature their requirements."

BAE says it remains in discussion with Northrop about its role on the T-X programme. Where it will fit in with the new aircraft remains to be seen, but it is offering to supply equipment including the embedded simulation capabilities already operational with the RAF's Hawk T2 fleet.

Both the Hawk and Typhoon programmes, meanwhile, serve as examples of BAE trying to keep its design work fresh.

### "With France we have a partner with a very similar goal and a similar approach"

**MICHAEL CHRISTIE**

Director of strategy and market development, BAE Systems Military Aircraft and Information

"The business strategy in the short to medium term is to generate revenue by selling Typhoons and Hawks. With both of those it does retain a level of design, because there is a lot of upgrade and sustainment work, particularly with Typhoon," Christie says.

"Similarly, Hawk keeps going through iterations of design – although not quite to the same scale as Typhoon – but what that doesn't do is sustain the total aircraft design capability.

"Part of the key is the big strategy, which is growth in the international market," he adds. "At a minimum it brings revenue, which keeps us live as a business, but as a maximum it brings us design work, because there are a number of countries where we're trying to develop collaborative efforts. The obvious one is France, where we are collaborating on UAVs and UCAVs [unmanned combat air vehicles] in particular, and this is the model that we have followed for some decades now."

BAE signed a contract with Dassault and the French and UK governments last November to conduct the air vehicle element of a feasibility study for a Future Combat Air System (FCAS).

Once the study is submitted at the end of 2016, a development effort leading to a demonstrator build and flight-test campaign is expected, although this was not given as a guaranteed commitment.

If the programme continues as expected, FCAS should come to fruition with a new capability by around 2030, the countries' procurement agency leads say. It is expected that

experience from BAE's Taranis UCAV demonstrator development with the UK MoD will contribute to its technology share during the two-year feasibility study phase.

"In partnering with France we have a partner with a very similar goal and a similar approach," Christie notes. "In the short term I think France will be a key collaborator."

Although BAE is involved in two UCAV demonstrator efforts – Taranis and FCAS – Christie notes that the restrictions surrounding the international Missile Technology Control Regime (MTCR) could prevent any commercial development and export of this kind of technology for all signatories of the treaty.

Beyond the collaboration with France, Christie says BAE is "trying to work on a longer-term export strategy, so that if we do develop unmanned systems, we don't end up with a very limited run. We want to be able to take them into the broader market, because it is a more limited market than the manned one. We'd like to develop a product that we could take externally."

### EXPORT

Christie stresses that the company advocates the export potential of developing a system from the outset, because "you have to think about export all the time and how you internationalise the product. I certainly envisage [unmanned] vehicles that could be exported, but it comes down to trying to match that to the military requirement of the UK".

While the UK government supports Taranis as a demonstrator, it is not something that BAE could commercialise and sell, he says. "The final operational vehicle – which the two-year Anglo-French FCAS feasibility study will determine – what is that final operational vehicle, and is it exportable?"

With regard to bringing a medium-altitude, long-endurance (MALE) UAV to market, Christie notes that the competitive landscape is very different to that for a UCAV.

"We're sitting in a slightly different place [to Europe]. The MALE UAV market has a much lower barrier to entry than the UCAV market, therefore there are lots more players. The key to success in that market is how you do it, not what the vehicle is, and that goes back to collaboration."

"We would want to collaborate in this and find customers that want us to do it with them. It's difficult to say 'I'm the best'. The most successful is the first to market."

Christie says there is no benefit in simply adding another product to an already saturated market, and notes that the USA and Israel are already very "successful and aggressive" in the MALE UAV sector. ■



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# WEIGHTY MATTERS

Delivery by a Royal Air Force A400M of an unidentified payload to support forces in Cyprus marks an important milestone after four turbulent months for the programme

**CRAIG HOYLE LONDON**

**A**s it touched down at the Royal Air Force's Akrotiri base in Cyprus in the evening of 3 March, aircraft ZM400 became the first Airbus A400M to deliver a payload of "vital freight" for the service.

Piloted by a crew from the RAF's Brize Norton-based 24 Sqn training unit, the "Atlas" carried an unspecified cargo load to Akrotiri, from where the UK is supporting US-led operations against Islamic State militants in Iraq with assets including Panavia Tornado GR4 strike aircraft.

The milestone event also delivered a boost for both the service and manufacturer, after what has been a turbulent four months for the multinational A400M programme since ZM400 – the RAF's first of an eventual 22 examples – was transferred last November. According to plans that were still in place at that time, the UK should have been in a position to declare initial operational capability (IOC) with the new type this month, on the introduction of its seventh example.

But even as the A400M programme's ninth production aircraft, MSN15, was being showcased inside Base Hangar at Brize Norton on

27 November, it was clear that this schedule was at risk. Exactly two months later, chief executive Tom Enders used an Airbus Group reception in London to apologise to the UK Ministry of Defence for problems affecting its delivery schedule for the new-generation airlifter. "We have additional delays and I very much regret that we are unable to meet the commitments made to our customers several years ago," he said.

## DELIVERIES

Despite the challenges facing the programme, which Enders says centre on so-called "travelled work" required on the A400M's fuselage and wing after their delivery to its San Pablo final assembly facility in Seville, Spain, Enders pledged that Airbus would strive to get the RAF's fleet "to seven aircraft at least" by the end of 2015. This target was confirmed during the company's annual results briefing in Munich on 27 February, and the UK now expects the Atlas to hit its IOC target during September, after a six-month delay.

Four of the RAF's aircraft have emerged so far, with ZM401/MSN16 having been flown to Airbus Defence & Space's Getafe facility near Madrid late last year to have its defensive aids system equipment installed. Once this work



Aircraft ZM400 touched down at Brize Norton last November

has been completed, the aircraft will be used to support trials of the self-protection suite.

The UK's third production aircraft – ZM402/MSN17 – touched down at Brize Norton on 27 February, while its fourth, ZM403/MSN20, was photographed in its service colours in Seville on 8 March, suggesting that its first flight is imminent.

Airbus expects to deliver around 16 A400Ms this year, and additional RAF aircraft should account for close to half of this total, also including MSNs 21 and 24 to 27.

In addition to supporting crew training tasks, the first application for the Atlas – as demonstrated by ZM400's recent flight to Cyprus – is to provide a strategic air transport capability. According to a schedule detailed by the service late last year, such flights should also be conducted in "non-benign" airspace from around June 2016.

For the RAF, the significance of the A400M having performed its first flight in support of operations over Iraq before the first frontline

Crown Copyright

Support equipment was flown to Akrotiri by a crew from the RAF's 24 Sqn training unit

Crown Copyright





pilots who will fly the type for its 70 Sqn have begun conversion training is evident.

"This task illustrates how we are developing the use of the aircraft in this early period," says Wg Cdr Simon Boyle, the unit's officer commanding. "We have been able to support defence operations while continuing to grow the experience of the force's aircrew instructors, before they begin to train the crews destined for 70 Sqn later this year."

According to the service's introduction plan, further capabilities will be added to the growing fleet, such as the airdrop of personnel and equipment, before its declaration for use as a tactical transport asset from September 2018. This will coincide with the phased draw-down of the RAF's smaller Lockheed Martin C-130Js, the first several of which will be retired later this year. This transition will lead to the A400M force, which also will include a second operational squadron, being declared fully deployable by March 2019, following the acceptance of its final aircraft.

Data provided by the RAF suggests that the A400M will be able to carry a 30t payload – 2t less than its usual maximum – a distance of 2,450nm (4,540km), 450nm further than a C-130J carrying just 12t.

Also boasting the ability to cruise at 37,000ft and Mach 0.72, the new type's range will be increased to 3,450nm with a 20t load, and to a maximum ferry distance of 4,700nm. The latter will enable an aircraft taking off from Brize Norton to fly nonstop to southern Africa, east Asia or the majority of North America.

#### GLOBAL REACH

"Every A400M crew will be capable of worldwide operations carrying passengers, freight and the majority of loads that we carry today," according to 24 Sqn officer commanding Wg Cdr Dorian James.

By 2022, the current planned out-of-service date for the UK's remaining Hercules, the A400M will have assumed all of the type's

roles, including supporting operations involving special forces personnel. For this requirement, selected crews will be trained to perform tactical flying by day or night down to 150ft, and for the aircraft to make high-altitude paratroop insertions from 40,000ft.

With the UK's A400M acquisition worth some £2.8 billion (\$4.2 billion), much is riding on the Atlas now delivering on its promised high performance, to complete a modern airlift force also including the Boeing C-17 strategic transport and Airbus A330 Voyager tanker/transport.

As Airbus strives to get back on track in delivering A400Ms with the contractually required level of operating capability, the near-term arrival of additional aircraft at Brize Norton should ensure that the RAF keeps to its schedule to transition from the hard-worked and less capable C-130J. As one senior officer notes: "We could not be any better positioned now, with regard to where we may wish to project in the future." ■

# EQUIPPING FOR NEW THREATS

With the UK's role in countering Islamic State militants adding to increased friction with Russia, its forthcoming defence review must answer key questions about assets

**BETH STEVENSON** LONDON

The island state of the UK is positioned – both politically and geographically – within a number of ongoing international conflicts. Its placing within NATO and the impact of tensions in the eastern part of Europe – as Moscow continues to posture – make it a target for Russian aggression as the alliance and the UK continue to condemn Moscow's actions and impose sanctions.

Russian military aircraft have flown too close to UK airspace for comfort in recent months, requiring the Royal Air Force to scramble Eurofighter Typhoons to escort the aircraft away from its territory.

Further afield, the threat from Islamic State militants as they spread throughout Iraq, Syria and Egypt has led to UK involvement in an air strike campaign against the insurgents in an effort to contain the group, plus involvement in training Iraqi forces on the ground.

With this in mind, British forces are anticipating the release of the government's Strategic Defence and Security Review (SDSR) in 2015, which should shed light on the future of a number of capabilities over the next five years.

"Conflicts of the past decade – Afghanistan, Iraq and more recently Libya – have shown the limitations of Western intervention," the Royal United Services Institute says in an SDSR 2015 summary. "Such conflicts pose difficult questions for future operations overseas; while short, sharp interventions may be more politically palatable than protracted stabilisation operations, strategic failure is in nobody's interest."

The fight against Islamic State extremists has already arguably affected the SDSR, as a Panavia Tornado GR4 squadron was reprieved ahead of its planned retirement in order to fill a

weapon capability gap in the Typhoon fleet.

UK Prime Minister David Cameron announced on 3 October that the RAF Marham-based 2 Sqn would continue to operate the Tornado until March 2016; it had previously been expected to stand down in March 2015, following the completion of the UK's combat involvement in Afghanistan. On 9 January, this was rebadged as 12 Sqn, with the 2 Sqn name transferred to a new Typhoon unit.

## RECUPERATION

The period after the government's SDSR of 2010 was expected to be one of recuperation for British forces, in terms of it being a conflict-free time in which forces could train and recover, but threats such as those posed by Russia have somewhat altered this.

The 2010 SDSR was released during a time of economic pressure in the UK, which led to a number of programme cuts. One of the most significant was the cancellation of the BAE Systems Nimrod MRA4 maritime patrol aircraft (MPA).

Russia has demonstrated the need for a UK at-sea surveillance capability, as it carries out flights over British waters, highlighting the gap that has been created as a result of the Nimrod cancellation.

"We're now at the point where we're looking at it quite carefully again, but only because fundamentally we're an island nation without maritime patrol aircraft – it just doesn't hang together very well and it doesn't tell a very good story," Douglas Barrie, senior fellow for military aerospace at the International Institute for Strategic Studies, tells *Flight International*.

A decision on an MPA is therefore expected to surface in the upcoming SDSR, but the path that the UK is likely to take remains unclear.



It could follow in the footsteps of the US Navy, Indian navy and Royal Australian Air Force, with the procurement of the technologically high-end Boeing P-8 Poseidon, complete with its anti-submarine and anti-surface warfare capabilities, or a more affordable aircraft, such as the Airbus C295.

Barrie says the Nimrod was a capable anti-submarine warfare aircraft, and ideally a replacement would match this. Although expensive, this would point towards the 737-800-derived P-8.

"That will be measured up against what deals are on the table and what are the ways in which you could fit what is going to be an expensive requirement into the budget," Barrie adds.

Through the UK's "Seedcorn" initiative, personnel from its armed forces have undergone training alongside the US Navy to increase operational readiness, which has included training on the P-8 as well as the Northrop Grumman MQ-4C Triton unmanned air vehicle. Other Seedcorn initiatives include allocating personnel to Lockheed P-3 Orions flown by



UK personnel have been training alongside the US Navy on the P-8

AirTeamImages



RAF Typhoons have been called on to escort Russian aircraft away from UK airspace

Australia, Canada and New Zealand.

While the nations on both sides of the Atlantic have continually affirmed that the UK's P-8 involvement does not determine which procurement path the UK will take, it certainly does ensure that the RAF would be ready to operate such an aircraft.

#### APPEALING

As the UK does with its Boeing RC-135W Rivet Joint and Boeing C-17 strategic transport fleets, it could tap into the support network that the USA has established for the P-8, making it a logically appealing option.

"I think all of the other options in the mix would really reflect the pressure on funding," Barrie notes. "To move away from a top-end solution would simply be driven by funding constraints. It's a question of capability – what kind of roles do we see ourselves playing in the world?"

Elsewhere, the UK's attack helicopter fleet is at risk of facing obsolescence problems if it is not replaced or upgraded.

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» The British Army's Boeing/AgustaWestland Apache AH1s will either need to be replaced with the new AH-64E Apache or another entirely new model of attack helicopter, or the current type could have obsolescent equipment replaced with up-to-date systems.

"It's been on the [defence] minister's desk for quite some time," Barrie says, adding that a new type of rotorcraft would be the least likely option.

"The safe bet is on an Apache-derived solution, but it is how you do that. Do you try and reuse some of the kit that you already have in the aircraft, or do you buy straight off the [AH-64E] line in the US?

"We need to get this moving. The fleet very quickly dwindles in terms of that obsolescence issue – it's a sooner rather than later decision, so I would have thought that they'd have to get that done during SDSR."

#### COMMITMENT

One new procurement for the UK is the Lockheed Martin F-35 Lightning II, with a solid commitment for 48 short take-off and vertical landing aircraft. The UK has so far ordered four F-35Bs to support initial operational test and evaluation and training, and confirmed orders for its first 14 fully operational examples.

"Somewhere in the 2015-2020 timeline, you would hope that we would be placing follow-on orders for the next tranche of aircraft to come through," Barrie notes, hinting at a possible reference to future numbers in the SDSR.

It is possible, therefore, that an indication will be made regarding future numbers and what is planned past the first 48 aircraft. The Tornado GR4 fleet is expected to have been fully retired by 2019, so more indication is needed regarding what is going to happen to the RAF's offensive fixed-wing fleet past this point.

Ultimately, the UK has the fifth-largest defence budget in the world, and is far enough ahead of sixth-ranked France to remain that way for some years. But as the country tries to retain its place as a capable military power, the realisation of its capabilities could make this stance questionable.

"Given the level of ambition that we've currently got to remain a full-spectrum, capable, medium-sized power, five squadrons of Typhoons and 48 F-35s split notionally between the air force and the navy does not seem to be enough by quite some distance," Barrie says.

A potential change of government in the UK's 7 May general election makes this an even more interesting time. At this pivotal point in decision-making, following what was considered by some as hasty activity in the last SDSR, both industry and the British defence forces will be anticipating the release of the new planning document, with significant decisions expected to be made. ■



**Operations against Islamic State militants led to a rethink about Tornado GR4 fleet size**



**The British Army could replace its current Apache AH1 model with the new-build AH-64E**



**Confirmed plans so far call for a buy of 48 short take-off and vertical landing F-35Bs**

From yuckspeak to tales of yore, send your offcuts to murdo.morrison@flightglobal.com

## Thinking inside the box

George W Bush said the trouble with the French is that they do not have a word for entrepreneur. Well, try this one: intrapreneur – someone in an organisation keen to develop his or her own business idea.

Airbus has just launched in Toulouse its new “global aerospace business accelerator”, where start-ups and Airbus “intrapreneurs or internal entrepreneurs” can work together to turn their visions into viable enterprises.

Do not underestimate its potential.

## Sutter tribute

Cargolux's latest 747-8F pays tribute to the Queen of the Skies' father, Joe Sutter, with a decal of the renowned Boeing engineer who led the team behind the original jumbo jet.

“We have built our business around the iconic 747 and wanted to celebrate our 30th direct delivery from Boeing by honouring the man behind this magnificent machine,” says Dirk Reich, chief executive of Cargolux.

The Luxembourg airline was the first operator of the stretch in 2011, and this is its 12th example. Cargolux also operated two 747-200s in the 1980s and in 1993 debuted the 747-400 freighter before taking 15 more.



## Arctic journey

Our data drones were intrigued by the announcement “Arctic Air set to make brief return to East Coast”. Which routes was it planning to fly? The alert was actually to do with the winter storms, but further in-depth research (Google search) revealed there was, in fact, a carrier called Arctic Air, albeit a fictional one – subject of a Canadian TV serial centred on a Yellowknife airline. But after the show was cancelled in 2014, even that has been grounded.

## Sleepy in Helsinki

Not for claustrophobes or those prone to sleeping through the alarm, but Helsinki is the latest airport to install GoSleep pods,



**Shut up...I'm resting**

Finnish-designed lie-flat airliner-type seats with a cover that shuts out light and noise for those wanting a nap between flights. These tiny hotel rooms have space for luggage, can be rented by the hour (room for one only!) and are already available at Abu Dhabi and Dubai.

For those seeking something a bit more reviving during a layover, there is always the airport's traditional sauna.



**Who's the daddy?** Joe Sutter is honoured on the side of Cargolux's latest 747-8F

## What's in a name?

According to a short notice in a German aeronautical journal,

**100 YEARS AGO** the German representatives of the British and Colonial Aeroplane

Co have changed the name of the firm, which is now known as the Halberstädter Flugzeugwerke. I prefer the original title considerably, and hope presently to see its use resumed.

## Sound preparation

Now comes the latest device for training personnel cheaply

**75 YEARS AGO** and rapidly on the ground. This time the objective is not flying training, but

the training of crews for the sound locators used by the air defences of all countries. The trainer produces in the pupil's ears a most realistic imitation of the sound the listener hears in a real sound locator.

## Floating on air

“Air-cushion vehicles” March supplement in next week's

**50 YEARS AGO** Flight will include a feature on the new Westland SR.N6 Hovercraft

and a specially prepared cutaway drawing, together with an article on driving the smaller SR.N5.

## Moscow muscle

The Soviet Air Force has been considerably reinforced in the

**25 YEARS AGO** past two years despite talk of East-West disarmament.

France's air-defence chief Gen Bernard Norlain made the statement at the end of a two-day nationwide exercise which included allied air forces.

**100-YEAR ARCHIVE**  
Every issue of Flight from 1909 onwards can be viewed online at [flightglobal.com/archive](http://flightglobal.com/archive)

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## Not an industry of stuntmen

How long will it be before an inexperienced aviator "collects the fence" in an ostentatious display of their unsuitability to be in control of an aircraft, flying into somewhere like Saint Maarten?

An Embraer pilot gives us a perfect example of this disregard for safety with a recently filmed video of ERJ-190 (PP-XMA) passing, what appears to be, less



### DISAPPEARANCE

## Likely cause of missing MH370

Having read the just-released interim statement by the Malaysian Safety Investigation Team for MH370, and related factual information, I am struck that neither the team nor apparently anyone else has remarked upon a departure from routine in the final radio broadcast from MH370. Protocol on being told to contact the next ATC agency is for a pilot to read back the frequency given to him by ATC, to ensure he has copied the correct frequency.

For example, the captain of MH370 does this when told by Lumpur Approach to contact Lumpur Radar. Yet when Lumpur Radar tells MH370 to contact Ho Chi Minh (on approaching Vietnamese airspace) on 120.9, the captain simply replies "Goodnight, Malaysian 370". He does not read back the frequency.

This is not routine and may indicate he had no intention of talking to Ho Chi Minh ACC or of continuing with his flight-planned routing to Beijing. In this case, it is no coincidence that within the next two minutes MH370's Mode S symbol disappeared from civil ATC radars, and military (primary) radar observed the aircraft turn onto an almost reciprocal heading.

In all the debate about what may have happened, I have never seen any reference to this anomaly in MH370's last radio transmission. Yet it lends support to the commonly held theory that the aircraft's disappearance was the result of human intervention from the flight deck.

**Mike Strong**

Farnham, Surrey, UK

than 10ft from beachgoers' heads, (screenshot attached).

We are an industry of professionals, not stuntmen, and pilots should be fixated on hitting the touchdown zone, rather than the fan pages of Instagram.

**Jon Salmon**

Corporate Communications Officer, AirTanker, London, UK

## Heading nowhere

A relevant detail not mentioned in the MH370 article written by David Learmount that refers to Capt Simon Hardy's calculations (*Flight International*, 13-19 January), is that Capt Hardy's hypothetical track flies exactly over the waypoint RUNUT, and this is really the last possible waypoint to the direction of the southern Indian Ocean (from IGREX or ANOKO) – after which

there is absolutely nothing.

It is the ideal final waypoint to go towards "nowhere".

**Fernando Ariño Grau**

Embraer Executive Jets, China

## Feeling the flying

Why are we still discussing appropriate flight training and the failure to recognise and do something about impending aerodynamic stalls?

Nowadays, getting or requiring three hours of "unusual attitudes" (which used to be normal ordinary flight instruction) is not rocket science.

And if you need a certain number of hours for a commercial licence or an airline transport pilot licence, it's not that difficult to sign up for 10 hours of aerobatics training.

Flying is not driving a car and

it's not like "operating" a sim.

There are people out there who have zero experience practising emergency procedures. I am shocked.

When I started flying in 1962 we had old planes and no stall warning horns to tell you if the wing was going to stop generating lift. The instructors would have you fly real slow and actually feel the airplane.

So I learned how to do stalls and spins and cross controlled slips and crabs.

By the time I showed up for my flight test in 1965, I had about an hour of slow flight, an hour of (very) steep turns, and an hour of crabs, cross controlled slips and gusty crosswind landings – which started in my second hour of instruction.

It's a little uncomfortable, but that's why you learn with an instructor. And these things are not acrobatics.

**Albert Masetti**

Harrington, Delaware, USA

## Missing facts

Are there any copy editors looking for work?

The TransAsia ATR 72 of the 4 February Taipei crash (reported in *Flight International*, 10-16 February) "previously had a faulty left engine, which was replaced in Macau". When was it replaced: last week, last year? No date appears in the article. This is useless "information" without the date.

Similarly, in an article on P25 in that same issue you report "On average, the [Indian] air force airlifts about 35,000t of cargo..."

When: daily, weekly, yearly? No time period is given in the article. This is useless "information" without the time period.

**James G Johnson**

Nanjing, China



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Published by Reed Business Information Ltd, Quadrant  
House, The Quadrant, Sutton, Surrey SM2 5AS, UK.  
Tel: +44 20 3148 3300.

Classified advertising prepress by CCM.  
Printed in Great Britain by William Gibbons and Sons Ltd.

Flight International published weekly 49 issues per year.  
Periodicals postage paid at Rahway, NJ. Postmaster send  
changes to Reed Business Information, c/o Mercury  
International Ltd, 365 Blair Road, Avenel, NJ 07001

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ISSN 0015-3710

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[isrconference.com](http://isrconference.com)

**20-23 April**

**AeroDef Manufacturing**  
Hilton Anatole, Dallas  
[aerodefevent.com](http://aerodefevent.com)

**24 April**

**Skytech**  
Business Design Centre, London  
[skytechevent.com](http://skytechevent.com)

**29-30 April**

**Loyalty@Freddie Awards**  
Atlanta, USA  
[flightglobalevents.com/loyaltyfreddies2015](http://flightglobalevents.com/loyaltyfreddies2015)

**1-3 May**

**Drones, Data X conference**  
Santa Cruz, California  
[nua.io](http://nua.io)

**4-7 May**

**AUVSI's Unmanned Systems**  
Atlanta, USA  
[auvishow.org](http://auvishow.org)

**10-11 May**

**Aviation Africa**  
Dubai, UAE  
[aviationafrica.aero](http://aviationafrica.aero)

**13-14 May**

**Ascend Asia: Finance Forum**  
Singapore  
[flightglobalevents.com/ascendasia2015](http://flightglobalevents.com/ascendasia2015)

**17-20 May**

**ALTA CCMA**  
Punta Cana, Dominican Republic  
[alta.aero/ccma](http://alta.aero/ccma)

**19-21 May**

**EBACE**  
Geneva, Switzerland  
[ebace.aero/2015](http://ebace.aero/2015)

**26-28 May**

**AP&M Europe**  
Olympia London, UK  
[apmexpo.com](http://apmexpo.com)

**31 May - 3 June**

**1st International Symposium on  
Sustainable Aviation (ISSA)**  
Istanbul, Turkey  
[issasci.org](http://issasci.org)

**4-6 June**

**France Air Expo**  
Lyon-Bron airport, France  
[franceairexpo.com](http://franceairexpo.com)

**15-21 June**

**Paris Air Show**  
Le Bourget, Paris  
[siae.fr](http://siae.fr)

**30 June**

**Ascend Europe: Finance Forum**  
London  
[flightglobalevents.com/ascendeurope2015](http://flightglobalevents.com/ascendeurope2015)

**17-19 July**

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**18-20 September**

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PHONE: 8901600-14, 8901680-94, FAX: 88-02-8901558, www.biman-airlines.com  
Ref: DACPM/737-800/154/2015/1456 Date: 19 February 2015

### Request for Proposal (RFP) for dry lease of one 737-800 aircraft

1. Biman Bangladesh Airlines Ltd. invites Proposal/Offer for taking of 01 (one) 737-800 aircraft for a period of 60 (sixty) months on dry lease basis. Airlines, Operators, Owners of Aircraft, Manufacturers, Leasing Companies having aircraft of its own or legally authorized by the owner may participate in the RFP complying with the terms & conditions given in the RFP Schedule. Basic requirements are mentioned below:

a. Number and Type of Aircraft	01 (one)737-800 aircraft.
b. Seat Configuration	Two class configuration with 162 (12J+150Y) seats. All seats shall have to be in good condition.
c. Age of the Aircraft	The aircraft should not be more than 10 years of age as on closing date of RFP.
d. Nature and period of Lease	Dry Lease for a period of 60 (sixty) months.
e. Commencement of Lease	July 2015.
f. Representation & Authorization	If the Bidder/Lessor is not the owner of the aircraft, then owner's authorization/ mandate must be submitted prior to negotiation.

2. Detailed information is available in the RFP Schedule. RFP Notice and Schedule may be viewed at Biman's website: [www.biman-airlines.com](http://www.biman-airlines.com).
3. The Proposal/Offer may be submitted to the General Manager (Corporate Planning) at E-mail: [dacpm154@bdbiman.com](mailto:dacpm154@bdbiman.com) by 1000 hours LT (0400 hrs UTC) on 16 March 2015. Proposal/Offer may also be submitted through Courier Service or dropped in the Box placed in the Office of the General Manager (Corporate Planning), Biman Head Office, Balaka, Kurmitola, Dhaka-1229 within the stipulated time. The Proposal(s)/Offer(s) will be opened immediately after the closing time in presence of the Bidder(s), if any. No Proposal/Offer would be accepted after the closing time. Biman Bangladesh Airlines Ltd. will not be responsible for late receipt of Proposal/Offer due to any reason, whatsoever.
4. For further information or query, General Manager (Corporate Planning) may be contacted at Telephone: +880-2-8901600/Extension-2415, +880-2-8901697 (direct), Fax+880-2-8901396, E-mail: [gmp@bdbiman.com](mailto:gmp@bdbiman.com) during the office hours.
5. Biman Bangladesh Airlines Ltd. reserves the right to accept or reject any or all the Proposals/Offers at any time and/or stage without assigning any reason, whatsoever, and no claim will be entertained in this regard.

Mohd. Abdur Rahman Faruky  
General Manager Corporate Planning (Acting)



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PHONE: 8901600-14, 8901680-94, FAX: 88-02-8901558, www.biman-airlines.com  
Ref: DACPM/777-200ER/153/2015/1455 Date: 19 February 2015

### Request for Proposal (RFP) for Dry Lease of one 777-200ER Aircraft

1. Biman Bangladesh Airlines Ltd. invites offers/proposals for Dry Lease of 01 (one) 777-200ER aircraft for a period of 60 (sixty) months. Airlines, Operators, Owners of Aircraft, Manufacturers, Leasing Companies having aircraft of its own or legally authorized by the owner to submit the offer, may participate in the RFP complying with the terms & conditions stated in the RFP schedule. Basic requirements are mentioned below:

i. Number and Type of Aircraft	01 (one) 777-200ER aircraft powered by PW4090 engine
ii. Nature & Period of Lease	Dry Lease for 60 (sixty) months.
iii. Configuration	Two class standard configuration not less than 319 seats. All seats shall have to be in good condition.
iv. Age of the Aircraft	The aircraft should not be more than 10 years of age as on closing date of RFP.
v. Authorization	If the Lessor is not owner of the aircraft, owner's authorization/mandate must be submitted prior to negotiation
vi. Commencement of Lease	July 2015

2. Detailed terms and conditions have been given in the RFP schedule. RFP notice and schedule may be viewed in Biman's web-site;[www.biman-airlines.com](http://www.biman-airlines.com) .
3. The Offers/Proposals are to be submitted latest by 1000 hours LT (0400 hrs UTC) 15 March 2015 addressed to General Manager (Corporate Planning), Biman Bangladesh Airlines Ltd., Head Office, Balaka, Dhaka, Bangladesh through E-mail at [dacpm153@bdbiman.com](mailto:dacpm153@bdbiman.com). Proposals/offers may also be submitted through courier service or dropped in the Tender Box placed in the office of General Manager (Corporate Planning), Biman Head Office, Balaka, Kurmitola, Dhaka-1229. No offer/proposal will be accepted after the closing time and date.
4. For further information or query, General Manager (Corporate Planning) may be contacted at Telephone: +880-2-8901600/Extension-2415, +880-2-8901697 (direct), Fax: +880-2-8901396, E-mail: [gmp@bdbiman.com](mailto:gmp@bdbiman.com) during the office hours.
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General Manager Corporate Planning (Acting)



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Ref: DACPM/777-300ER/155/2015/1461 Date: 24 February 2015

### Request for Proposal (RFP) for Dry Lease of one 777-300ER Aircraft

1. Biman Bangladesh Airlines Ltd. invites offers/proposals for Dry Lease of 01 (one) 777-300ER aircraft for a period of 60 (sixty) months. Airlines, Operators, Owners of Aircraft, Manufacturers, Leasing Companies having aircraft of its own or legally authorized by the owner to submit the offer, may participate in the RFP complying with the terms & conditions stated in the RFP schedule. Basic requirements are mentioned below:

i. Number and Type of Aircraft	01 (one) 777-300ER aircraft.
ii. Nature & Period of Lease	Dry Lease for 60 (sixty) months.
iii. Configuration	Two class configuration not less than 419 seats. All seats shall have to be in good condition.
iv. Age of the Aircraft	The aircraft should not be more than 10 years of age as on closing date of RFP.
v. Authorization	If the lessor is not the owner of the aircraft, owner's authorization/mandate must be submitted prior to negotiation.
vi. Commencement of Lease	July 2015

2. Detailed terms and conditions have been given in the RFP schedule. RFP notice and schedule may be viewed in Biman's web-site:[www.biman-airlines.com](http://www.biman-airlines.com) .
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The Branch is seeking suitable applicants for three positions: an **Air Historian**, a **Research Manager** and a **Researcher**.

A minimum entry qualification of a good honours degree or equivalent qualification in Modern History or a related subject is sought. A strong interest in the history of the Royal Air Force as well as a good knowledge of air power and its application, preferably as a practitioner, would be advantageous. For the senior post a post-graduate qualification in a relevant discipline is considered essential. Nationality requirements pertain to all of the vacancies.

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## WORK EXPERIENCE TIM BARBER

# Life of an international jet seller

Tim Barber is regional managing director of business aircraft sales broker and consultancy JetBrokers as well as a partner in Daher TBM 900 distributor Aura Aviation, roles that take him around the world in search of buyers

## Why did you pursue a career in the aviation industry?

It began by chance, really. I came out of a senior corporate role and was taking some time with my young family. After a year or so I started thinking about a new challenge. At that time, I was approached by John Merry, now my business partner in Aura Aviation and the business formerly known as JetBrokers Europe, to see if I'd be interested in bringing an established and respected US aircraft sales brand into Europe, and that was my first dealings with JetBrokers. John had bought and sold many of his own personal aircraft through JetBrokers over a number of years and believed that they had the professionalism and integrity to make a long-term partner. After much research and due diligence we launched JetBrokers Europe at NBAA 2009. We subsequently gained the distributorship for the Daher-Socata TBM 850 and created Aura Aviation to oversee that side of the business. We continue as aircraft sales representative for the now upgraded and renamed TBM 900.

**Tell us about your current role?**  
I am pretty mobile. At the end of last year I was in Georgia, India, the USA and Istanbul within a few weeks of each other. I also travelled to Dubai twice in three weeks, along with other European cities. We need to see the aircraft that we are selling or buying and we also have to visit our clients and prospects. So on any given day I can be anywhere in the world. Not only am I looking for



Barber co-launched JetBrokers (then Europe) at the NBAA show in 2009

aircraft to sell and also actively selling aircraft, but I am also looking out for new business partners, new locations and so on. Most days I'll find five minutes to log onto the social media channels that we use, mainly LinkedIn and Twitter, both of which are increasingly interesting platforms that can't be ignored. There'll be many conference calls between the various teams across the globe, invariably at strange times of day, and when there's a deal to close then it's easy to get totally consumed at this stage of the process.

**Where do you source aircraft?**  
They are sourced globally. We have listings of aircraft in Europe, Asia, the Middle East and, of course, the USA. We have enormous physical and virtual networks and this is effectively our lifeblood. We gain our listing of aircraft to sell through direct contact with owners, although a good proportion of the leads will come about as a result of intro-

ductions from business partners, satisfied customers, aviation professionals and recommendations from former clients and so on.

## How is the market for pre-owned business jets in Europe?

The market today is certainly showing some signs of improvement. It's not unusual for brokers to be talking the market up, but we closed five deals in January and had a strong February, selling three Learjets in a single week. Our biggest challenge now is to replace the sold inventory with new aircraft to sell. Fortunately we have quite a few acquisition projects keeping us busy at the moment, but our for-sale inventory is now down to around 20-25 aircraft, which is about as low as I have seen it.

Everyone I speak to in our sector reports a good level of activity, but it's easy to be busy whilst not achieving results. At present I feel we are seeing a pretty busy sector and the results will hopefully be

reflected in the statistics as we move through 2015. However, all too often the sales are only being achieved as a result of aggressive pricing. The market is very segmented and in some areas we see the inventory rising and prices falling, while in other areas we see stable or reducing inventory accompanied by more stable pricing. Basic supply and demand economics, but it's fascinating just how localised it can be.

## What are the major challenges for an aircraft broker?

The main challenges are the inundation of enquiries from prospective buyers from dubious sources. You can't write off any enquiry, but it's clear many of the Gmail, Yahoo or Hotmail accounts they come from are merely our competitors researching. I just wish everyone made the enquiry in their real name and stated that they were researching, because in the long run we'd all benefit: brokers, owners, sellers and buyers. Finding listings is always a challenge, and it's always disappointing to be verbally promised something, only to later see a U-turn – but we're all used to that by now. It's patience and tenacity – you have to play the long game. ■

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